

Characterization of Emissions from Motor  
Vehicles Designed for Low NO<sub>x</sub> Emissions

Southwest Research Inst.  
San Antonio, TX

Prepared for

Environmental Sciences Research Lab.  
Research Triangle Park, NC

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CHARACTERIZATION OF EMISSIONS FROM MOTOR  
VEHICLES DESIGNED FOR LOW NO<sub>x</sub> EMISSIONS

by

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Contract No. 68-02-2497

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| 16. ABSTRACT<br>Tailpipe emissions were characterized for four advanced low NO <sub>x</sub> catalyst equipped passenger cars under a variety of cyclic driving conditions. All of the vehicles had three-way catalysts, three with feedback carburetors and exhaust gas recirculation, and two with oxidation catalysts following the three-way catalysts. The emission rates of several unregulated pollutants including aldehydes, organic amines, sulfur dioxide, nitrous oxide, several individual hydrocarbons (including benzene), hydrogen sulfide, cyanide, organic sulfides, nickel carbonyl, ammonia, sulfate, trace metals, and N-nitrosodimethylamine were determined. Additionally, the emission rates of the regulated pollutants, total hydrocarbons, carbon monoxide, and oxides of nitrogen were determined along with carbon dioxide and oxygen. Using three test fuels of varying sulfur content, the emissions were examined at an initial mileage and at 5,000-mile intervals to 15,000 miles. Using a toxicity criteria, the most significant emissions were the currently regulated pollutants; sulfate was the most significant unregulated pollutant. Using commuter exposure models, exposures less than 0.07 OSHA 8-hour Threshold Limit Values are projected for typical congested freeway situations. |                                                            |                                            |
| 17. KEY WORDS AND DOCUMENT ANALYSIS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                            |                                            |
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| *Air pollution                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Unregulated pollutants                                     | 13B                                        |
| *Automobiles                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                            | 13F                                        |
| *Exhaust emissions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                            | 21B                                        |
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| Catalytic converters                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                            | 07A                                        |
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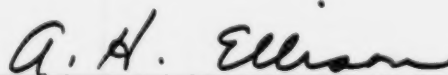


## FORWARD

Section 202(a)4 of the Clean Air Act as amended in 1977 requires assurance that no emission control device, system, or element of design used in a new motor vehicle or new motor vehicle engine cause or contribute to an unreasonable risk to public health, welfare, or safety. In determining whether an unreasonable risk exists, the emission rates of unregulated pollutants shall be considered. The Environmental Protection Agency, in Advisory Circular 76, identified several unregulated pollutants of interest.

The Environmental Sciences Research Laboratory in EPA's Office of Research and Development sponsors programs for general characterization of emissions from mobile sources. The emission rates of many sulfur and nitrogen containing unregulated pollutants under a variety of driving conditions are determined. The sensitivity of the emissions to vehicle speed and load, fuel characteristics, ambient temperature, and vehicle emission control configuration is studied.

This report describes the results of a contractual effort with Southwest Research Institute to characterize emissions from passenger cars equipped with three-way catalyst emission control devices. The emission rates of over 40 compounds were determined for four vehicles under four varied cyclic driving patterns. The fuel sulfur content was also varied. Emission rates were determined at 5,000 mile intervals to 15,000 miles, permitting determination of the changes in emissions with limited mileage accumulation.



A.H. Ellison  
Director  
Environmental Sciences Research Laboratory

## PREFACE

The project, "Characterization of Emissions from Motor Vehicles Designed for Low NO<sub>x</sub> Emissions", for which this report is a part was initiated by the U.S. Environmental Protection Agency, Research Triangle Park, North Carolina. The scientific and engineering effort on which this report is based was accomplished by the Department of Emissions Research, Southwest Research Institute, 6220 Culebra Road, San Antonio, Texas, under EPA Contract Number 68-02-2497. This report encompasses the effort to accomplish Task III of this project, "Characterization of Emissions from Motor Vehicles Designed for Low NO<sub>x</sub> Emissions". Task I of this project included a detailed literature search to determine candidate analytical methods to measure several unregulated compounds or groups of compounds in exhaust including nitrous oxide, hydrogen cyanide, ammonia, sulfuric acid, sulfur dioxide, cyanogen, organic amines, N-nitrosodimethylamine, hydrogen sulfide, carbonyl sulfide, organic sulfides and nickel carbonyl. Task II of this project included the validation and qualification of the methods selected in Task I. The results of Task II have been published and are available in an EPA publication entitled "Analytical Procedures for Characterizing Unregulated Pollutant Emissions from Motor Vehicles." Task III of this project which is described by this report, involved the use of the selected analytical methods to measure exhaust emissions from gasoline powered automobiles which use catalytic methods to achieve low oxides of nitrogen. Task III of this project began December 1978 and was completed February 1980. The EPA Project Officer during this period was Frank Black. The project was initially under the supervision of Sherrill F. Martin, Project Leader, and Harry E. Dietzmann, Manager of Chemical Analyses. Lawrence R. Smith, Senior Research Scientist and Harry E. Dietzmann directed the project beginning August 1978. This project was identified within Southwest Research Institute as Project 11-4840-001.

## ABSTRACT

Regulated and unregulated emissions from motor vehicles designed for low  $\text{NO}_x$  emissions were characterized. The emission rates of several unregulated pollutants including aldehydes, organic amines, sulfur dioxide, nitrous oxide, several individual hydrocarbons including benzene, hydrogen sulfide, total cyanide, organic sulfides, nickel carbonyl, ammonia, sulfate, trace metals, and N-nitrosodimethylamine were assessed for four vehicles. In addition to the analyses for the pollutants listed above, analyses for total hydrocarbons, carbon monoxide, oxides of nitrogen, carbon dioxide and oxygen were also conducted. All four of the vehicles tested had three-way catalyst systems. Three of the four also had feedback carburetors and EGR. Two of these three had a three-way catalyst followed by an oxidation catalyst with additional air introduced between the catalysts. The fourth vehicle had an oxygen sensor regulated fuel injection system. The emissions were evaluated at an initial mileage, 5000 miles, 10,000 miles, and 15,000 miles with three fuels. The first fuel had a low sulfur content ( $<0.003$  weight percent), the second fuel consisted of the first fuel blended to 0.03 weight percent sulfur, and the third fuel was a commercial grade fuel blended to 0.03 weight percent sulfur. From the standpoint of toxicity, the most significant emissions from three-way catalyst systems are the currently regulated emissions, followed to a lesser degree by the sulfate emissions.

This report was submitted in fulfillment of Contract No. 68-02-2497 by the Department of Emissions Research, Southwest Research Institute under the sponsorship of the U.S. Environmental Protection Agency. This report covers a period from December 1, 1978 to February 29, 1980, and work was completed as of March 31, 1980.

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## SECTION 1

### INTRODUCTION

This report describes the effort to characterize regulated and unregulated exhaust emissions from four gasoline powered vehicles designed for low NO<sub>x</sub> emissions. This characterization was the third task of the project "Characterization of Emissions from Motor Vehicles Designed for Low NO<sub>x</sub> Emissions." The project was initiated by the U.S. Environmental Protection Agency, Research Triangle Park, North Carolina under EPA Contract Number 68-02-2497. Task I of this project included a detailed literature search to determine candidate analytical methods to measure each of the following unregulated compounds or groups of compounds in exhaust.

|                        |                  |
|------------------------|------------------|
| Nitrous Oxide          | Hydrogen Sulfide |
| Hydrogen Cyanide       | Sulfuric Acid    |
| Ammonia                | Sulfur Dioxide   |
| Cyanogen               | Carbonyl Sulfide |
| Organic Amines         | Organic Sulfides |
| N-nitrosodimethylamine | Nickel Carbonyl  |

Task II of this project included the validation and qualification of the methods selected in Task I. The results of Task II were published and are available in Interim Report II, an EPA publication entitled "Analytical Procedures for Characterizing Unregulated Pollutant Emissions from Motor Vehicles."<sup>(1)</sup> This interim report also contains as an appendix Interim Report I, which contains the results of Task I. Task III of this project, which is described by this report, involved the use of the selected analytical methods to measure exhaust emissions from gasoline powered automobiles which use catalytic methods to achieve low oxides of nitrogen.

### PROJECT OBJECTIVE

The objective of this project was to select, qualify, and then utilize measurement instrumentation and techniques for the characterization of regulated (hydrocarbons, carbon monoxide, and oxides of nitrogen) and a variety of currently non-regulated (i.e., ammonia, hydrogen cyanide, sulfates, etc.) exhaust emissions from gasoline automobiles using various catalytic methods to achieve low oxides of nitrogen.

### EMISSIONS EVALUATED

The emission rates of several unregulated pollutants including aldehydes and ketones (formaldehyde, acetaldehyde, acetone, isobutyraldehyde, methyl-ethylketone, crotonaldehyde, hexanaldehyde, and benzaldehyde), organic amines (monomethylamine, dimethylamine, trimethylamine, monoethylamine, diethylamine, and triethylamine), sulfur dioxide, nitrous oxide, individual

hydrocarbons (methane, ethylene, ethane, acetylene, propane, propylene, benzene, and toluene), hydrogen sulfide, total cyanide (hydrogen cyanide and cyanogen), organic sulfides (carbonyl sulfide, methyl sulfide, ethyl sulfide, and methyl disulfide), nickel carbonyl, ammonia, sulfate, trace metals, and n-nitrosodimethylamine were assessed for four vehicles. These compounds were measured to attempt to fully characterize partially oxidized or reduced hydrocarbon, sulfur, and nitrogen emissions as well as the extremely toxic nickel carbonyl. In addition to the analyses for the pollutants listed above, analyses for total hydrocarbons, carbon monoxide, oxides of nitrogen, carbon dioxide, and oxygen were also conducted. The emissions were evaluated at an initial mileage and after mileage accumulations of 5,000 miles up to 15,000 miles with three fuels at each mileage point. The sequence was selected to determine the effect of mileage on the emission control systems (i.e., the oxygen sensor which regulates the fuel/air ratio must be replaced at 15,000 miles on the Saab 99). The test sequence included replicate tests using the Light-Duty Federal Test Procedure (FTP)<sup>(2)</sup>, the Congested Freeway Driving Schedule (SET)<sup>(3)</sup>, the Highway Fuel Economy Driving Schedule (HFET)<sup>(4)</sup>, and the New York City Cycle (NYCC)<sup>(5)</sup>. These driving cycles were selected to represent a variety of driving patterns and test cycle speeds. The FTP cycle contains a cold- and hot-start whereas the other three test cycles are hot-start cycles.

#### VEHICLES EVALUATED

Four automobiles were utilized in this project. Included were a 1978 Saab, a 1978 Ford Pinto, a 1978 Pontiac Sunbird, and a 1979 Mercury Marquis. These vehicles were selected to represent a range of vehicle inertia weights and emission control systems that were available at the time of the study. The Saab, Pinto, and Sunbird had three-way catalysts and were certified for sale in California. The Marquis had a three-way catalyst and was certified for sale in 49 states. The Saab had an oxygen-sensor regulated continuous fuel injection system. The Pinto, Sunbird, and Marquis had feed-back carburetors and EGR. The catalytic converter on the Pinto and the Marquis consisted of a three-way catalyst followed by an oxidation catalyst, with additional air introduced between the catalysts.

#### FUELS EVALUATED

The regulated and unregulated emissions were evaluated using three fuels. The first fuel had a low sulfur content (less than 0.003 weight percent sulfur), the second fuel consisted of the first fuel blended to 0.03 weight percent sulfur with a 50/50 mixture of thiophene and t-butyldisulfide, and the third fuel was a commercial grade fuel blended to 0.03 weight percent sulfur with thiophene. These fuels were selected to determine the effects of fuel sulfur on the emissions from three-way catalyst systems.

#### VEHICLE TESTING

The four vehicles were tested with the three fuels at four test points; at an initial mileage and after mileage accumulation of 5,000 miles up to 15,000 miles. At each test point the vehicles were preconditioned for 200

miles with the fuel to be tested. Duplicate tests for each vehicle with each fuel at each test point were conducted using the Light-Duty Federal Test Procedure (FTP) (2), the Congested Freeway Driving Schedule (SET) (3), the Highway Fuel Economy Driving Schedule (HFET) (4), and the New York City Cycle (NYCC) (5). Preconditioning and the 5000 mile accumulations were conducted in accordance with the 55 mph Alternate Mileage Accumulation Procedure (6).

## SECTION 2

### GENERAL EQUIPMENT, INSTRUMENTS, PREPARATION AND PROCEDURES

This section describes the vehicles, the fuels and lubricant, the facilities and the general instrumentation and procedures utilized in this project. The overall sampling system for the unregulated emissions is also discussed.

#### VEHICLES

Four new gasoline powered automobiles were evaluated in this project. These automobiles, a 1978 Ford Pinto, a 1978 Pontiac Sunbird, a 1978 Saab 99, and a 1979 Mercury Marquis are described in Table 1. The Pinto, Sunbird, and Saab were provided by the respective manufacturers. The Marquis was leased from a local San Antonio leasing agency. All four automobiles came equipped with normally obtained options such as automatic transmission and air conditioning (except Pinto), with the standard rear-axle ratio and with standard size tires. The Saab 99 had front wheel drive.

#### FUELS AND LUBRICANTS

The three fuels used throughout this project are described in Table 2. The first fuel (Fuel #1, SwRI identification number EM-379-F) had a low sulfur content (less than 0.003 weight percent sulfur), the second fuel (Fuel #2, SwRI identification number EM-380-F) consisted of the first fuel blended to 0.03 weight percent sulfur, and the third fuel (Fuel #3, identification number EM-377-F) was a commercial grade fuel blended to 0.03 weight percent sulfur. Fuel #1 was made in accordance with the specifications outlined in MSAPC Advisory Circular No. A/C 26B1 and contained no measurable manganese. Fuel #1 (EM-379-F) was prepared at a local refinery to be an average unleaded gasoline (national average in composition) with a very low sulfur content (<0.003 weight percent sulfur). Fuel #2 (EM-380-F) was prepared at SwRI by blending Fuel #1 to a sulfur content of 0.03 weight percent with a 50/50 mixture by sulfur weight of thiophene and t-butyldisulfide. To 50 gallons of Fuel #1, 48 ml (21 grams sulfur) of thiophene and 61 ml of t-butyldisulfide (21 grams sulfur) were added to give 0.029 weight percent sulfur. Eight drums of Fuel #2 were prepared in this manner. Fuel #3 (EM-377-F) was Gulf Crest Unleaded Regular Gasoline which had an original sulfur content of 0.016 weight percent. This weight percent was brought up to 0.031 by blending in thiophene.

Sulfur analyses were conducted using the lamp sulfur method except in the case of determining the percentage of sulfur in Fuel #1. For Fuel #1 the supplier used microcoulometry to determine a sulfur weight percent of 0.0018. Liquid chromatography and x-ray by two other laboratories indicated the sulfur weight percent of Fuel #1 to be <0.005 and 0.01 respectively.

TABLE 1. AUTOMOBILES EVALUATED UNDER CONTRACT NO. 68-02-2497

| Car Number | Vehicle |         |         |           |                     | GVWR, kg |
|------------|---------|---------|---------|-----------|---------------------|----------|
|            | Year    | Make    | Model   | Body Type | ID or Serial Number |          |
| 21         | 1978    | Ford    | Pinto   | 2-dr      | BR10Y131366         | 1552     |
| 22         | 1978    | Pontiac | Sunbird | Hatchback | 2M2718u520438       | 1720     |
| 23         | 1978    | Saab    | 99      | 2-dr      | 99781008246         | 1728     |
| 24         | 1979    | Mercury | Marquis | 2-dr      | 9Z63H620874         | 5365     |

| Car Number | Engine  |                    | Emission Controls         |          |     |
|------------|---------|--------------------|---------------------------|----------|-----|
|            | CID/Cyl | Family             | Catalyst                  | Air Pump | EGR |
| 21         | 140/4   | 2.3"B" (ITR80XR80) | 3-way + oxi. <sup>a</sup> | Yes      | Yes |
| 22         | 151/4   | 820X6EU8BEV        | 3-way                     | No       | Yes |
| 23         | 121/4   | B120CA             | 3-way                     | No       | No  |
| 24         | 351/8   | 5.8"BV" (2TT95X95) | 3-way + oxi. <sup>a</sup> | Yes      | Yes |

| Car Number | Fuel Control System |               | Chassis Dynamometer Settings <sup>b</sup> |                             |
|------------|---------------------|---------------|-------------------------------------------|-----------------------------|
|            | Fuel Control        | Oxygen Sensor | Inertia, kg (lbs)                         | Power, kw (hp) <sup>c</sup> |
| 21         | Feed-back carb.     | Yes           | 1250 (2750)                               | 8.0 (10.7)                  |
| 22         | Feed-back carb.     | Yes           | 1360 (3000)                               | 6.7 (9.0)                   |
| 23         | Continuous Inj.     | Yes           | 1360 (3000)                               | 8.5 (11.3)                  |
| 24         | Feed-back Carb.     | Yes           | 2040 (4500)                               | 8.9 (12.0)                  |

Note: All four automobiles were equipped with:

Automatic Transmission  
Air Conditioning (except Pinto)

<sup>a</sup> Three-way catalyst followed by an oxidation catalyst

<sup>b</sup> Same as settings used in EPA certification of each automobile

<sup>c</sup> Includes the increase for air conditioning



TABLE 2. FUEL DESCRIPTION

| Item                       | Fuel                    |          |          |
|----------------------------|-------------------------|----------|----------|
|                            | Fuel #1<br>(Low Sulfur) | Fuel #2  | Fuel #3  |
| SwRI Identification Number | EM-379-F                | EM-380-F | EM-377-F |
| Distillation (Deg °F)      |                         |          |          |
| I.B.P.                     | 85                      | 85       | 87       |
| 5%                         | 105                     | 105      | 108      |
| 10%                        | 118                     | 118      | 123      |
| 20%                        | 138                     | 138      | 151      |
| 30%                        | 167                     | 167      | 178      |
| 40%                        | 204                     | 204      | 204      |
| 50%                        | 231                     | 231      | 229      |
| 60%                        | 249                     | 249      | 249      |
| 70%                        | 267                     | 267      | 275      |
| 80%                        | 286                     | 286      | 311      |
| 90%                        | 335                     | 335      | 345      |
| 95%                        | 364                     | 364      | 368      |
| End Point                  | 405                     | 405      | 419      |
| % Recovery                 | 98.0                    | 98.0     | 99.0     |
| % Residue                  | 0.8                     | 0.8      | 0.5      |
| % Loss                     | 1.2                     | 1.2      | 0.5      |
| RVP                        | 9.4                     | 9.4      | 11.0     |
| Gravity (specific)         | 0.7527                  | 0.7527   | 0.7309   |
| Lead g/gal                 | 0.001                   | 0.001    | 0.003    |
| Phosphorus g/gal           | 0.0002                  | 0.0002   | 0.0001   |
| Manganese g/gal            | <0.001                  | <0.001   | 0.002    |
| F.I.A.                     |                         |          |          |
| % Aromatics                | 37.5                    | 37.5     | 22.8     |
| % Olefins                  | 6.8                     | 6.8      | 7.2      |
| % Saturates                | 55.7                    | 55.7     | 70.0     |
| Research Octane            | 92.0                    | 92.0     | 91.0     |
| Motor Octane               | 83.8                    | 83.8     | 83.2     |
| R + M/2                    | 87.9                    | 87.9     | 87.1     |
| Sulfur (weight percent)    |                         |          |          |
| Before addition of sulfur  | <0.003                  | <0.003   | 0.016    |
| After addition of sulfur   | --                      | 0.029    | 0.031    |



The engine lubricant used in this project was Exxon Uniflow 10W40 motor oil. This motor oil, in addition to having a significant sales volume, contained an additive for reducing engine friction. At the time this motor oil was initially selected, there were indications that many or most major motor oil manufacturers were planning to incorporate similar friction additives into their motor oil.

#### DYNAMOMETER AND CVS SYSTEM

A Clayton Model ECE-50 chassis dynamometer with a belt-driven variable-inertia flywheel system was utilized for all transient testing. The belt-driven inertia system simulates equivalent weight of vehicles from 680 kg (1500 lbs) to 2495 kg (5500 lbs) in 115 kg (250 lbs) increments to 1360 kg and 225 kg increments above 1360 kg.

The constant volume sampler (CVS) used for these evaluations was Southwest Research Institute CVS Number 2. This unit has a nominal capacity of 9.2 m<sup>3</sup>/min (325 cfm). A nominal 460 mm (18 inch) diameter by 5 m (16 feet) long dilution tunnel was used between the intake filter and the CVS to enable sampling of sulfates.

Partial views of the chassis dynamometer and the intake and dilution tunnel to the CVS can be seen in Figure 1. Both the dynamometer and the CVS were calibrated, maintained and operated in accordance with the manufacturer's instructions and the appropriate sections of the code of Federal Regulations applicable to light-duty vehicles.<sup>(2)</sup>

In addition to the 142 m<sup>3</sup>/min (5000 cfm) cooling fan placed in front of the automobile, 42 m<sup>3</sup>/min (1500 cfm) blowers were available to cool each rear wheel and to blow the heat from the exhaust pipe away from the automobile's gasoline tank. These additional blowers were used only during the SET and HFET driving cycles.

#### EXHAUST SAMPLING AND ANALYSIS

A pictorial schematic of the exhaust and sampling system is shown in Figure 2. This system is in accordance with the guidelines established in various projects conducted at SwRI for the EPA. The major difference between this system and similar systems used in other projects is the number of sampling probes and systems required to collect all of the required unregulated emission samples. This is illustrated in the several views of the system shown in Figure 1.

This section has described the dilution tunnel and provided some insight into the overall sampling system assembly. More details on each of the individual sampling systems for the unregulated emissions are given in Section III of this final report.

#### INSTRUMENTATION FOR REGULATED EMISSIONS

Bagged samples of the dilute exhaust were evaluated for HC, CO, NO<sub>x</sub>, and CO<sub>2</sub> using SwRI Bag Cart Number 1. This bag cart was designed, calibrated and operated in accordance with the appropriate sections of the Code of

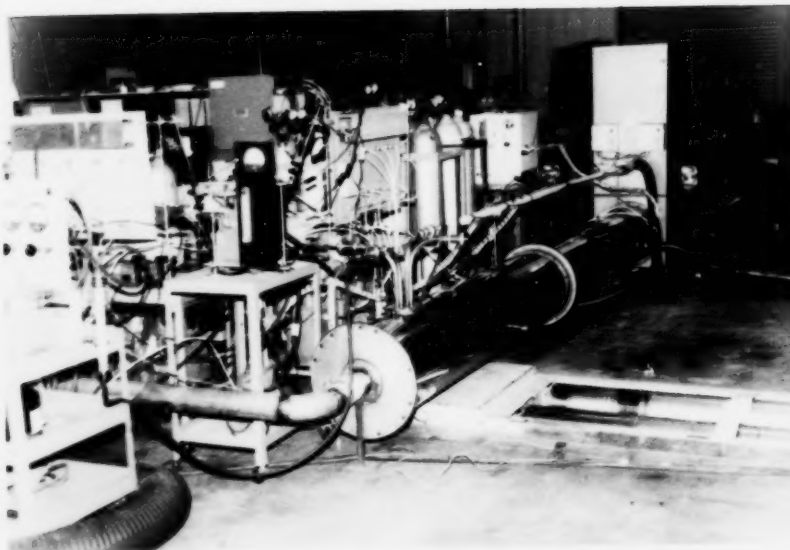
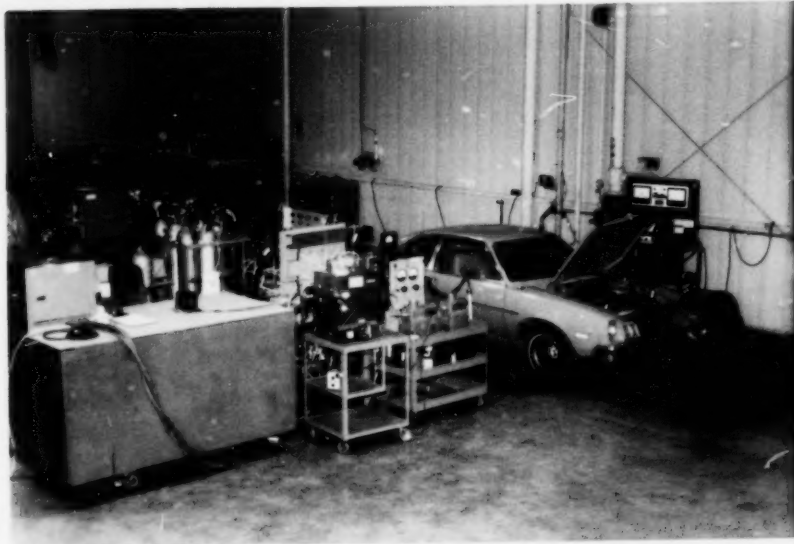


Figure 1. Views of exhaust sampling system.

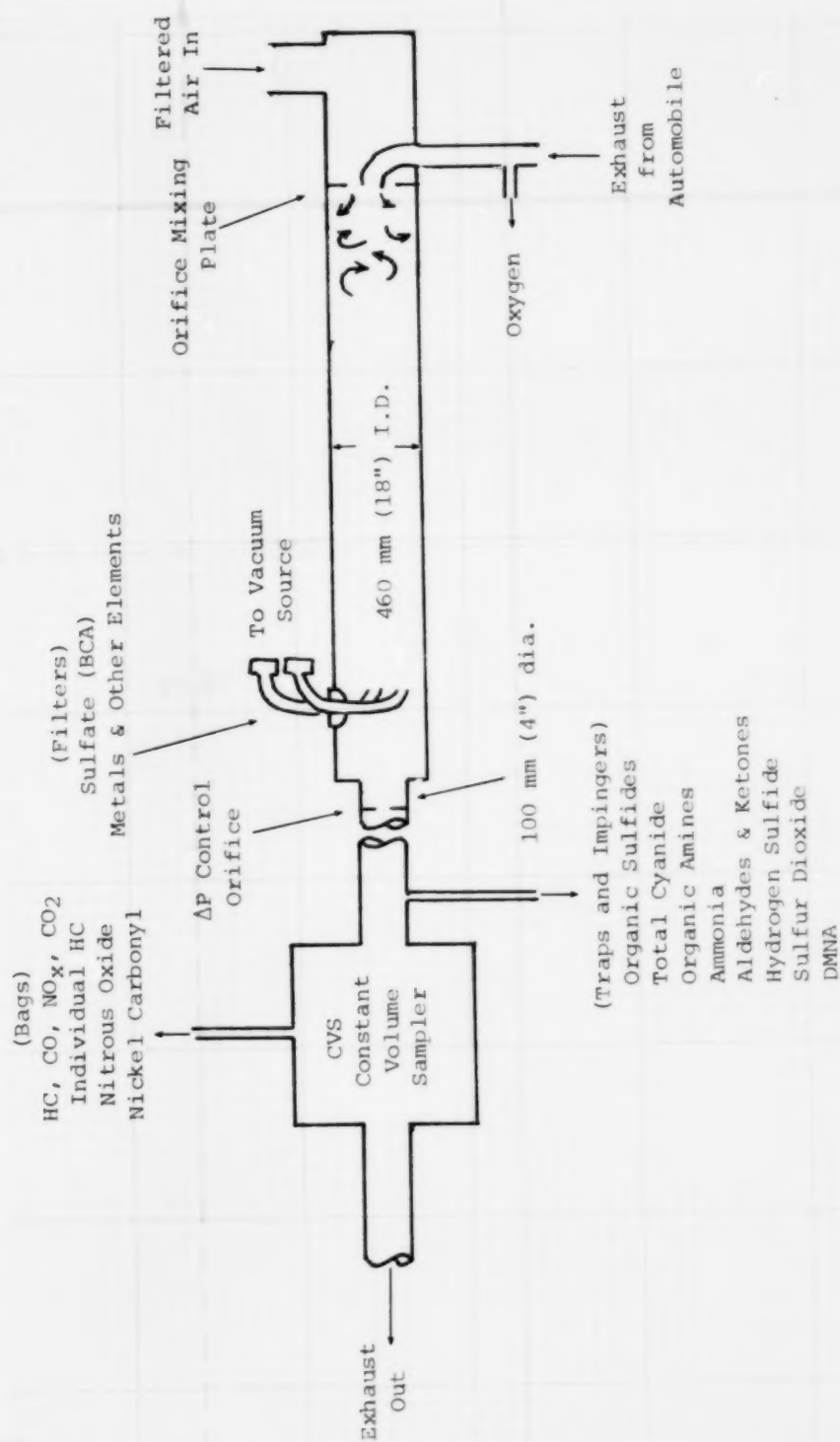


Figure 2. Emission sampling system.

Federal Regulations applicable to light-duty vehicles.<sup>(2)</sup>

Items that were continuously recorded were the vehicle speed and the oxygen level in the undiluted exhaust. The instrumentation used for these continuously recorded data were as follows:

| Parameter Measured | Instrument or Method                          |              |             |
|--------------------|-----------------------------------------------|--------------|-------------|
|                    | Type                                          | Make & Model | Ranges Used |
| O <sub>2</sub>     | Polarographic                                 | Beckman 715  | 5 & 25%     |
| Speed              | Parallel output from the Dynamometer Controls |              |             |

#### EMISSIONS TEST AND MILEAGE ACCUMULATION PROCEDURES

The primary procedures and driving schedules utilized in this project, are defined as follows:

FTP - 1979 Federal Test Procedure<sup>(2)</sup> (uses the Urban Dynamometer Driving Schedule)

SET - Congested Freeway Driving Schedule<sup>(3)</sup>

HFET - Highway Fuel Economy Driving Schedule<sup>(4)</sup>

NYCC - New York City Cycle<sup>(5)</sup>

Modified MVMA - 55 mph alternate Mileage Accumulation Procedure<sup>(6)</sup>  
(with all WOT accelerations changed to normal accelerations). This procedure is described in Appendix A-1.

Each of the four primary procedures and schedules, requiring emissions testing in this project (FTP, SET, HFET, and NYCC) utilized bagged samples for evaluation of regulated emissions and fuel consumption.

The SET, the HFET, and the NYCC are hot-start, single-segment driving cycles. The FTP, however, involves cold-start and hot-start, multi-cycle with multi-segment operation. In addition, in this project a four-bag FTP was utilized for most of the unregulated emissions; rather than the three-bag FTP specified in the Federal Test Procedure. Therefore, before proceeding, it is important to clarify the meaning of FTP as used in this project:

FTP - The FTP uses the Urban Dynamometer Driving Schedule (UDDS) which is 1372 seconds in duration. The UDDS, in turn, is divided into two segments; the first having 505 seconds and the second having 867 seconds. The Federal Test Procedure consists of a cold-start 505 and a stabilized 867 followed by a hot-start 505. In this project, the hot 505 was followed by another 867 segment. For the remainder of this discussion, and throughout this report, the four-cycle FTP will be identified as follows:

|                            | Four-Cycle FTP |       |          |       |
|----------------------------|----------------|-------|----------|-------|
|                            | Cold UDDS      |       | Hot UDDS |       |
| Cycle                      | 1              | 2     | 3        | 4     |
| Duration, seconds          | 505            | 867   | 505      | 867   |
| Regulated Emissions, 3-Bag | X              | X     | X        |       |
| Regulated Emissions, 4-Bag | X              | X     | X        | X     |
| Unregulated Emissions:     |                |       |          |       |
| Bag                        | X              | X     | X        | X     |
| Impinger                   | ---            | X --- | ---      | X --- |
| Trap (Except DMNA)         | ---            | X --- | ---      | X --- |
| Trap DMNA                  | -----          | X     | -----    |       |

NOTE: X designates a sample taken

A composite value in mass per distance for the three-cycle, three-sample FTP regulated emissions is calculated using the following formula:

$$\frac{\text{MASS}}{\text{DISTANCE}} = \frac{0.43 \times (\text{MASS 1} + \text{MASS 2}) + 0.57 \times (\text{MASS 3} + \text{MASS 2})}{0.43 \times (\text{DIST. 1} + \text{DIST. 2}) + 0.57 \times (\text{DIST. 3} + \text{DIST. 2})}$$

Assuming Distance 3 is equal to Distance 1, this equation can be reduced to:

$$3\text{-FTP M/D} \approx \frac{0.43 \times (M1 + M2) + 0.57 \times (M3 + M2)}{D1 + D2}$$

For the four-cycle FTP, two sample, composite values determined in this project, the following formula was used:

$$\frac{\text{MASS}}{\text{DISTANCE}} = \frac{0.43 \times M(1 + 2) + 0.57 \times M(3 + 4)}{0.43 \times (D1 + D2) + 0.57 \times (D3 + D4)}$$

Assuming Distance 3 is equal to Distance 1 and Distance 4 is equal to Distance 2, then this equation can be reduced to:

$$4\text{-FTP M/D} \approx \frac{0.43 \times M(1 + 2) + 0.57 \times M(3 + 4)}{D1 + D2}$$

Therefore, with the assumption that the changes in distance traveled are negligible, the composite results with the four-cycle FTP relative to results with the three-cycle FTP will differ only as the mass emissions emitted during Cycle 4 differ from that emitted during Cycle 2.

The test sequence followed for each automobile is given in Table 3. Sequences 1 through 11 were repeated for each automobile. The sequence followed in the laboratory for running one set of emissions tests (FTP, SET, HFET and NYCC) is given in Table 4.

The parameters of the four primary driving schedules are summarized in Table 5 and these schedules are illustrated in Figure 3. Other driving schedule designations frequently used are as follows:

| <u>Driving Schedule<br/>Designation Used</u> | <u>Other Common<br/>Designations</u> |
|----------------------------------------------|--------------------------------------|
| FTP                                          | LA-4 and UDDS                        |
| SET                                          | CFDS and SET-7                       |
| HFET                                         | FET                                  |
| NYCC                                         | SET-8                                |

#### TEST CODING SYSTEM

The test coding system used in this project was established for use in four related unregulated emission projects. The system allows the tests to be numbered so that the vehicle, mileage accumulation test point, fuel, test (original or duplicate), and driving cycle can be easily determined from the test numbers. This test coding system is described in Table 6.

#### COMPUTATIONAL METHODS

The methods used for calculating the unregulated emission results are given in Appendix A-2. All regulated emissions were calculated using the methods prescribed in the Code of Federal Regulations for Light-Duty Vehicles<sup>(2)</sup>. On the computer printouts for the regulated emissions, included in Appendix D, all items of potential interest are identified by descriptive headings. Items on the computer sheet identified only by abbreviated headings are used in calculating the unregulated emissions.



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TABLE 3. TEST SEQUENCE FOR EACH AUTOMOBILE

| Step         | Operation                                                                                       |
|--------------|-------------------------------------------------------------------------------------------------|
| Upon receipt | Tune-up to manufacturers specifications                                                         |
| 1            | Precondition with Fuel #1 for 200 miles using modified MVMA                                     |
| 2            | Run FTP, SET, HFET, NYCC with Fuel #1, - Sample and analyze regulated and unregulated emissions |
| 3            | Repeat Step 2                                                                                   |
| 4            | Repeat Steps 1-3 with Fuel #2                                                                   |
| 5            | Repeat Steps 1-3 with Fuel #3                                                                   |
| 6            | Accumulate 5000 miles using Fuel #3                                                             |
| 7            | Repeat Steps 1-5                                                                                |
| 8            | Repeat Step 6                                                                                   |
| 9            | Repeat Steps 1-5                                                                                |
| 10           | Repeat Step 6                                                                                   |
| 11           | Repeat Steps 1-5                                                                                |

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TABLE 4. PROJECT 11-4840 TEST SEQUENCE

1. Precondition with UDDS
2. Soak 12 to 20 hours
3. FTP - Sample 4 bags; 2 filters, 2 impingers, or 2 traps
  - a) Cold start - 1 bag } 1 filter, 1 impinger, or 1 trap
  - b) Stabilize - 1 bag
  - c) 10 min soak
  - d) Hot start - 1 bag } 1 filter, 1 impinger, or 1 trap
  - e) Stabilize - 1 bag
4. Soak 10 minutes
5. Precondition with first 505 seconds of UDDS
6. Idle 1 minute ( $\pm 15$  seconds)
  - a) automatic transmission-drive
  - b) additional cooling blowers started
7. SET - Sample 1 bag sample, 1 filter, 1 impinger, or 1 trap
8. Precondition with HFET
9. Idle 1 minute ( $\pm 15$  seconds) - (automatic transmission-drive)
10. HFET - Sample 1 bag sample, 1 filter, 1 impinger, or 1 trap
11. Soak 10 minutes
12. Precondition with first 505 seconds of UDDS
13. Idle 1 minute ( $\pm 15$  seconds) - (automatic transmission-drive)
14. NYCC - Sample 1 bag sample, 1 filter, 1 impinger, or 1 trap

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TABLE 5. SUMMARY OF DRIVING SCHEDULE PARAMETERS

|      | <u>Duration,<br/>Seconds</u> | <u>Distance,<br/>Kilometers</u> | <u>Average Speed</u> |            |
|------|------------------------------|---------------------------------|----------------------|------------|
|      |                              |                                 | <u>km/hr</u>         | <u>mph</u> |
| FTP: |                              |                                 |                      |            |
| 505  | 505                          | 5.8                             | 41.3                 | 25.7       |
| 867  | 867                          | 6.2                             | 25.8                 | 16.2       |
| UDDS | 1372                         | 12.0                            | 31.4                 | 19.5       |
| SET  | 1398                         | 21.7                            | 56.0                 | 34.8       |
| HFET | 765                          | 16.5                            | 77.6                 | 48.2       |
| NYCC | 599                          | 1.91                            | 11.5                 | 7.1        |

TABLE 6. TEST CODING SYSTEM

P V M F S T

P: Project Code Number = 2

V: Vehicle Number; 1 = Pinto, 2 = Sunbird, 3 = Saab, 4 = Marquis

M: Mileage Accumulation Point; 0 = Initial, 1 = 5,000 miles,  
2 = 10,000 miles, 3 = 15,000 miles

F: Fuel; 1 = Fuel No. 1 (low sulfur fuel), 2 = Fuel No. 2 (Fuel No. 1  
blended to 0.030 weight percent sulfur), 3 = Fuel No. 3  
(commercial grade of fuel)

S: Test; 1 = Initial set of test cycles, 2 = repeat of Test 1

T: Driving Cycle; 1 = FTP, 2 = SET-7, 3 = HFET, 4 = NYCC

Example: 210111

Ford Pinto tested at initial mileage and Fuel No. 1,  
first test and FTP driving cycle

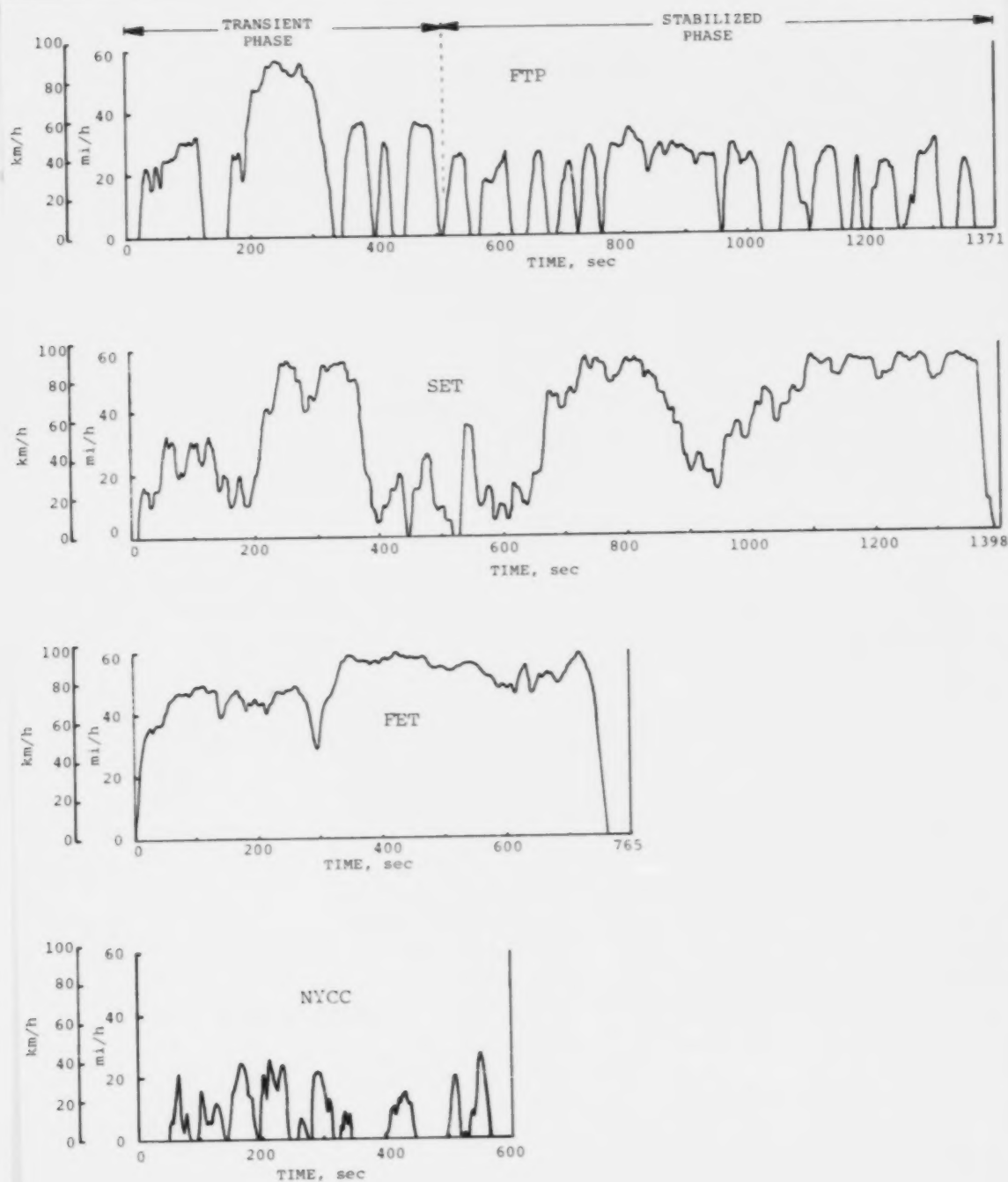


Figure 3. Driving cycle speed vs time traces.

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### SECTION 3

#### ANALYTICAL PROCEDURES FOR UNREGULATED EMISSIONS

The analytical procedures used to measure the unregulated emissions are summarized in this section. A detailed description of the procedures, along with a discussion of their development, validation, and qualification, is available in the report "Analytical Procedures for Characterizing Unregulated Pollutant Emissions From Motor Vehicles," by Dietzmann, H.E. et al(1).

The unregulated emissions evaluated in this project, along with the methods for sampling and the procedures used in the analyses, are listed in Table 7. Organic amines, aldehydes and ketones, organic sulfides, individual hydrocarbons, and metals and other elements represent groups of compounds. The respective procedures separate and identify a number of individual compounds within each of these groups. The analytical procedures involved in this project are described briefly as follows:

**Organic Amines** - The collection of organic amines (monomethylamine, monoethylamine and dimethylamine, trimethylamine, diethylamine, and triethylamine) is accomplished by bubbling CVS diluted exhaust through glass impingers containing dilute sulfuric acid. The amines are complexed by the acid to form stable sulfate salts which remain in solution. A portion of this solution is then injected into a gas chromatograph equipped with an ascarite loaded pre-column and a nitrogen phosphorus detector (NPD). External amine standards in dilute sulfuric acid are used to quantify the results.

**Ammonia** - The collection of ammonia is accomplished by bubbling CVS diluted exhaust through impingers containing dilute sulfuric acid at ice bath temperatures. A sample from the impinger is then analyzed for ammonium ion,  $\text{NH}_4^+$  by the use of an ion chromatograph and the concentration in the exhaust is calculated by comparison to an ammonium sulfate standard solution.

**Aldehydes and Ketones** - The collection of aldehydes (formaldehyde, acetaldehyde, isobutyraldehyde, hexanaldehyde, crotonaldehyde, and benzaldehyde) and ketones (acetone and methylethylketone) is accomplished by bubbling CVS diluted exhaust through glass impingers containing 2,4-dinitrophenylhydrazine (DNPH) in dilute hydrochloric acid. The aldehydes and ketones (also known as carbonyl compounds) react with the DNPH to form their respective phenylhydrazone derivatives. These derivatives are insoluble or only slightly soluble in the DNPH/HCl solution and are removed by filtration followed by pentane extractions. The filtered precipitate and the pentane extracts are combined and then the pentane is evaporated in a vacuum oven. The remaining dried extract contains the phenylhydrazone derivatives. The extract is dissolved in a quantitative volume of toluene containing a known

TABLE 7. SAMPLING AND ANALYSIS METHODOLOGY FOR UNREGULATED EMISSIONS

| Compound                                  | Sampling | Method of Analysis                                                                       |
|-------------------------------------------|----------|------------------------------------------------------------------------------------------|
| Organic Amines                            | Impinger | Gas chromatography with ascarite pre-column and nitrogen-phosphorus detector (GC-NPD).   |
| Ammonia (NH <sub>3</sub> )                | Impinger | Ion chromatography                                                                       |
| Aldehydes and Ketones                     | Impinger | Dinitrophenylhydrazone derivative; Gas chromatography with flame ionization detector     |
| Hydrogen Sulfide (H <sub>2</sub> S)       | Impinger | Methylene blue derivative; Spectrophotometer                                             |
| Total Cyanide                             | Impinger | Cyanogen chloride derivative; Gas chromatography with electron capture detector (GC-ECD) |
| Organic Sulfides                          | Trap     | Gas chromatography with flame photometric detector (GC-FPD)                              |
| Nitrous Oxide (N <sub>2</sub> O)          | Bag      | Gas chromatography with electron capture detector (GC-ECD)                               |
| Nickel Carbonyl<br>(Ni(CO) <sub>4</sub> ) | Bag      | Chemiluminescence (CL)                                                                   |
| Individual Hydrocarbons                   | Bag      | Gas chromatography with flame ionization detector                                        |
| Metals and Other<br>Elements              | Filter   | Weighed using microbalance; X-ray fluorescence analysis at RTP                           |
| Sulfate                                   | Filter   | Barium chloranilate derivative (BCA); liquid chromatography with ultraviolet detector    |
| DMNA                                      | Trap     | Gas chromatography with mass spectrometer at RTI (GC-MS)                                 |
| Sulfur Dioxide                            | Impinger | Ion chromatography                                                                       |



amount of anthracene as an internal standard. A portion of this dissolved extract is injected into a gas chromatograph and analyzed using a flame ionization detector.

**Hydrogen Sulfide** - The collection of hydrogen sulfide is accomplished by bubbling CVS diluted exhaust through glass impingers containing a buffered zinc acetate solution which traps the sulfide ion as zinc sulfide. The absorbing solution is then treated with N,N-dimethyl-paraphenylene diamine sulfate and ferric ammonium sulfate. Cyclization occurs, forming the highly colored heterocyclic compound methylene blue (3,9-bisdimethyl-aminophenazothionium sulfate). The resulting solution is analyzed with a spectrophotometer at 667 nm in a 1-cm or 4-cm pathlength cell depending upon the concentration.

**Total Cyanide (Hydrogen Cyanide plus Cyanogen)** - The collection of total cyanide is accomplished by bubbling CVS diluted exhaust through glass impingers containing a 1.0 N potassium hydroxide absorbing solution. This solution is maintained at ice bath temperature. An aliquot of the absorbing reagent is then treated with  $\text{KH}_2\text{PO}_4$  and Chloramine-T. A portion of the resulting cyanogen chloride is injected into a gas chromatograph equipped with an electron capture detector (ECD). External  $\text{CN}^-$  standards are used to quantify the results.

**Organic Sulfides** - The collection of the organic sulfides, carbonyl sulfide ( $\text{COS}$ ), methyl sulfide (dimethylsulfide),  $(\text{CH}_3)_2\text{S}$ , ethyl sulfide (diethylsulfide,  $(\text{C}_2\text{H}_5)_2\text{S}$ ), and methyl disulfide (dimethyl disulfide,  $(\text{CH}_3)_2\text{S}_2$ ), is accomplished by passing CVS diluted exhaust through Tenax GC traps at  $-76^\circ\text{C}$ . At this temperature the traps remove the organic sulfides from the dilute exhaust. The organic sulfides are thermally desorbed from the traps into a gas chromatograph sampling system and injected into a gas chromatograph equipped with a flame photometric detector for analysis. External organic sulfide standards generated from permeation tubes are used to quantify the results.

**Nitrous Oxide** - For measurement of nitrous oxide, a sample of the CVS diluted exhaust is collected in a Tedlar bag. This bagged sample is then analyzed for nitrous oxide using a gas chromatograph equipped with an electron capture detector. Calibration blends are used to quantify the results. Gas chromatograph peak areas are determined using a Hewlett-Packard 3354 computer system.

**Nickel Carbonyl** - Bagged samples of the CVS diluted exhaust are analyzed for nickel carbonyl ( $\text{Ni}(\text{CO})_4$ ) using a chemiluminescent  $\text{NO}_x$  analyzer modified with a No. 54 Wratten filter. Bottled calibration blends are used to quantify the results. The instrument has linear response between 0.1 ppb and 100 ppb.

**Individual Hydrocarbons** - For measurement of the individual hydrocarbons, methane ( $\text{CH}_4$ ), ethane ( $\text{C}_2\text{H}_6$ ), ethylene ( $\text{C}_2\text{H}_4$ ), acetylene ( $\text{C}_2\text{H}_2$ ), propane ( $\text{C}_3\text{H}_8$ ), propylene ( $\text{C}_3\text{H}_6$ ), benzene ( $\text{C}_6\text{H}_6$ ), and toluene ( $\text{C}_7\text{H}_8$ ), a sample of CVS diluted exhaust is collected in a Tedlar bag. This bagged sample is

then analyzed for individual hydrocarbons using a gas chromatograph system containing four separate columns and a flame ionization detector. The peak areas are compared to an external calibration blend and the individual hydrocarbon concentrations are obtained using Hewlett-Packard 3354 computer system.

**Metals and Other Elements** - The metals are collected as particulate on 47-mm Fluoropore filters, which are then sent to EPA-Research Triangle Park (RTP) for analysis by X-ray fluorescence spectrometry. The diluted exhaust samples are taken isokinetically from within the dilution tunnel. Weight gain on the filter is determined by weighing the filter on a microbalance before and after sampling.

**Sulfate** - Automotive exhaust is vented into a dilution tunnel where it is mixed with a flowing stream of filtered room air. In the tunnel, the  $\text{SO}_3$  reacts rapidly with water in the exhaust to form sulfuric acid aerosols. The aerosols grow to a filterable size range within the tunnel and are collected isokinetically on a fluorocarbon membrane filter. Particulate sulfate salts are also collected on the filter.

Sulfuric acid collected on the filter is then converted to ammonium sulfate by exposure to ammonia vapor. The soluble sulfates are leached from the filter with a measured volume of an isopropyl alcohol - water solution (60% IPA). A fixed volume of the sample extract is injected into a high pressure liquid chromatograph (HPLC) and pumped through a column of strong cation exchange resin in  $\text{Ag}^+$  form to scrub out the halides ( $\text{Cl}^-$ ,  $\text{Br}^-$ ) and then through a column of strong cation exchange resin in  $\text{H}^+$  form to scrub out the cations and convert the sulfate to sulfuric acid. Passage through a reactor column of barium chloranilate crystals precipitates out barium sulfate and releases the highly UV absorbing chloranilate ions. The amount of chloranilate ions released is equivalent to the sulfate in the sample and is measured by a sensitive liquid chromatograph UV detector at 310-313 nanometers. All the reactions and measurement take place in a flowing stream of 60% IPA. The scrubber and reactor columns also function as efficient filter media for any solid reaction products formed during passage of the sample through the column system.

**DMNA** - The measurement of N-nitrosodimethylamine is accomplished by collecting dilute exhaust (approximately 185:1 total dilution) in Tenax GC sampling cartridges and shipping the cartridges to Research Triangle Institute (RTI) for analysis by capillary gas-liquid chromatography/mass spectrometry.

**Sulfur Dioxide** - The concentration of sulfur dioxide in dilute automotive exhaust is determined by the use of an ion chromatograph. Sulfur dioxide samples are collected as sulfate in two glass bubblers, each containing three percent hydrogen peroxide. The temperature of the absorbing solution is maintained at  $0^\circ\text{C}$  by means of an ice water bath. The samples are then analyzed on the ion chromatograph and compared to standards of known sulfate concentrations.

The analytical procedures used in this project were subjected to a series of validation and qualification experiments. Validation experiments included checks for sample stability, sample collection efficiency, detector linearity, interferences, and analysis repeatability. The qualification experiments included the injection of the compound of interest into the tunnel with and without the presence of exhaust and the subsequent recovery of that compound at the procedure sampling point.

Sample stability checks were performed using repeated analyses of the same sample at intervals over a specified period of time and comparing the results to the initial analysis. Organic amines, aldehydes and ketones, ammonia, total cyanide, nitrous oxide, individual hydrocarbon, and sulfur dioxide samples were found to be stable for several days. Organic sulfides and the hydrogen sulfide samples were found to be stable for approximately one day. Nickel carbonyl is stable for only a few hours.

Sample collection efficiency experiments were performed by passing a known concentration of sample through a series of impingers or traps and analyzing each impinger or trap individually for the compound of interest. All procedures used in this project have a collection efficiency of 98% or better. Detector linearity experiments were performed by preparing several samples of various known concentrations and plotting the resulting peak areas versus the concentrations. All the procedures had linear response over the concentration range of interest in this project.

To determine the interferences for each procedure, known exhaust components were introduced into the sample to determine their effect on the resultant measurements. To determine analysis repeatability, several samples of known concentrations were prepared and a number of complete analyses were performed at each concentration. The results of these tests were then compared to determine analyses repeatability.

The qualification experiments were performed to determine if the compounds of interest could travel the length of the dilution tunnel in the presence of dilute exhaust without significant loss by reaction with exhaust or the tunnel itself. The compounds were introduced at the same point at which the exhaust enters the tunnel and were sampled at the normal sampling point. Table 8 lists the procedures for which validation and qualification experiments were performed.

TABLE 8. PROCEDURAL VALIDATION AND QUALIFICATION

| Compound or<br>Compound Group | Validation<br>Conducted | Qualification Conducted         |
|-------------------------------|-------------------------|---------------------------------|
| Organic Amines                | Yes                     | Yes (significant tunnel losses) |
| Ammonia                       | Yes                     | Yes (significant tunnel losses) |
| Aldehydes and Ketones         | Yes                     | Yes                             |
| Hydrogen Sulfide              | Yes                     | Yes                             |
| Total Cyanide                 | Yes                     | Yes                             |
| Organic Sulfides              | Yes                     | Yes (significant tunnel losses) |
| Nitrous Oxide                 | Yes                     | Yes                             |
| Nickel Carbonyl               | Yes                     | No <sup>a</sup>                 |
| Individual Hydrocarbons       | Yes                     | No <sup>b</sup>                 |
| Metals and Other Elements     | No <sup>b</sup>         | No <sup>b</sup>                 |
| Sulfate                       | No <sup>b</sup>         | No <sup>b</sup>                 |
| DMNA                          | No <sup>c</sup>         | No <sup>c</sup>                 |
| Sulfur Dioxide                | Yes                     | Yes                             |

<sup>a</sup>

Compound considered too dangerous to perform qualification experiments

<sup>b</sup>

Established procedure

<sup>c</sup>

Performed at EPA-RTP and RTI

SECTION 4

VEHICLE TESTING

Four vehicles were tested in this project with three fuels at four mileage test points. These mileage test points included testing at an initial mileage and after mileage accumulations of 5,000 miles up to 15,000 miles. At each test point the vehicles were preconditioned for 200 miles with the fuel to be tested. Duplicate tests for each vehicle with each fuel at each mileage test point were conducted using the Light-Duty Federal Test Procedure (FTP), the Congested Freeway Driving Schedule (SET), the Highway Fuel Economy Driving Schedule (HFET), and the New York City Cycle (NYCC).

The modified MVMA, 55 mph alternate Mileage Accumulation Procedure (described in Appendix A-1) was used to accumulate the 200 miles for preconditioning with each fuel and the 5000 miles between each series of test points. The fuel economy (miles/gallon) for each vehicle for each of the three 5000 mile accumulations as well as an overall mileage accumulation average is listed below:

|         | <u>First 5000</u><br><u>Mile Accum</u> | <u>Second 5000</u><br><u>Mile Accum</u> | <u>Third 5000</u><br><u>Mile Accum</u> | <u>Average</u> |
|---------|----------------------------------------|-----------------------------------------|----------------------------------------|----------------|
| Pinto   | 21.9                                   | 20.4                                    | 21.1                                   | 21.1           |
| Sunbird | 19.8                                   | 17.1                                    | 20.0                                   | 19.0           |
| Saab    | 23.1                                   | 20.5                                    | 22.4                                   | 22.0           |
| Marquis | 14.7                                   | 13.4                                    | 13.9                                   | 14.0           |

The second 5000 mile accumulation was carried out during the hot summer months.

During the course of the project, a few unscheduled maintenance problems were encountered. The rear end went out on the Pinto after approximately 2000 miles during the Pinto's first 5000 mile accumulation. The failure was due to either an initial low lubricant level in the rear axle, a lubricant leak in the rear axle or both. The rear end was replaced and no further problems were encountered with the Pinto. The Saab's front disc brake pads had to be replaced in each of the three 5000 mile accumulations. Also some minor transmission problems were encountered during the third 5000 mile accumulation for the Saab. During the second 5000 mile accumulation the Marquis' automatic transmission began slipping and it was necessary to take the Marquis to the dealer for repair. Also during this mileage accumulation period, the Marquis' rear tires had to be replaced due to excessive wear. The oxygen sensor on the Pontiac Sunbird was replaced after testing with



fuel #1 at the first 5000 mile accumulation test point. Also a faulty manifold gasket was replaced in the exhaust manifold during the Sunbird's second 5000 mile accumulation.

All regulated (HC, CO, NO<sub>x</sub>) and except for DMNA and other potentially hazardous compounds, all unregulated (aldehydes and ketones, organic amines, sulfur dioxide, nitrous oxide, individual hydrocarbons, hydrogen sulfide, total cyanide, organic sulfides, nickel carbonyl, ammonia, sulfate, and trace elements) pollutants emission rates, as well as fuel consumption, oxygen, raw exhaust concentrations, and carbon dioxide emission rates were measured throughout the project. DMNA samples were collected only after the third 5000 mile accumulation and only during one of the two duplicate series of tests with each fuel for each vehicle (48 samples, 4 vehicles x 3 fuels x 4 driving cycles). These DMNA samples were sent to Research Triangle Institute, RTP, North Carolina for analysis. At the time of this report, the results of these analyses were not available and will appear in a separate report by RTI for the EPA. Samples were also taken at the third 5000 mile accumulation test point for other potentially hazardous compounds from only the Pinto NYCC test cycle. These samples were also sent to RTI for analyses and the results of these tests will appear in another RTI report to the EPA. Sulfur dioxide sampling problems were encountered at the initial test point and after the first 5000 mile accumulation test point. Because of these problems, sulfur dioxide data is reliable only after the second and third 5000 miles accumulation test points. Summaries of the test results are included in Appendix B. Individual sample data for the FTP evaluations are included in Appendix C and the computer printouts for the regulated emissions are included in Appendix D. The results of the x-ray analyses for metals and other elements are included in Appendix E.

In all data tables, a double dash (--) has been inserted when no test data were available. This occurred when valid test data could not be obtained due to sampling or instrument malfunction or loss of sample.

All FTP unregulated emissions data, with the exception of DMNA, are based on appropriately weighted four-cycle FTP results. The DMNA evaluations consisted of a single trap taken continuously over the first three cycles of the four-cycle FTP. If most of the DMNA were formed during the cold-start 505, then the reported DMNA data would be on the high side (up to a maximum of about 1.5 times the value that would be obtained in a standard weighted three-sample FTP). If the DMNA were produced at a constant rate in all three cycles, then such weighted composite results would be essentially identical to these continuous sample three-cycle results.



## SECTION 5

### RESULTS AND DISCUSSION

In this section a discussion of the emissions data obtained during the testing of this project will be presented. This testing generated a large volume of data for each pollutant studied. Duplicate tests with four vehicles, three fuels, four mileage test points and four driving cycles were conducted for each regulated and unregulated pollutant. The FTP driving cycle consisted of either a two, three, or four segment evaluation depending on the pollutant. The testing in this project gave from 480 (two segment FTP evaluation) to 672 (four segment FTP evaluation) data points for each pollutant studied. The data has been grouped, averaged, and tabulated in this section in order to compare the pollutant (unregulated or regulated) emission rates as to 1) vehicle, 2) driving cycle, 3) fuel, 4) mileage, and 5) cold versus hot start operation. Due to the large number of variables associated with each data point, advanced statistical analyses were judged to be inapplicable. The emission rates will be presented in grams per kilometer for the regulated emissions and in milligrams per kilometer for the unregulated emissions. Emission standards for the regulated emissions and minimum detection values (MDV) for both regulated and unregulated emissions have been included with the tabulated data. The MDV as used in this report is defined as the value above which it can be said that the compound has been detected in the exhaust (i.e., the accuracy is equal to plus or minus the MDV at a measured value equal to the MDV). The MDV varies from one test cycle to another for the same pollutant due to variations in the sampling times (the shorter the sampling time the larger the MDV-except for bag samples) and variations in the volume of exhaust emitted from a vehicle per kilometer driven (the more exhaust per kilometer, the larger the MDV). Values are recorded in the tables which are equal or less than the MDV. These values are average values and indicate that in only a percentage of the tests was a detectable amount of pollutant found. In several cases, some compounds were not detected and a value of ND has been inserted into the tables. The value of ND indicates the pollutant in question could not be detected even in trace amounts and with certainty is less than the MDV in all analyses conducted.

In order to compare vehicle and/or test cycle emission rates, average emission rates for each pollutant from each of the four vehicles operating over the four test cycles have been recorded in tables entitled "Vehicle and Test Cycle Comparisons." Each value in the "Vehicle and Test Cycle Comparisons" tables represents the average of 24 tests (2 duplications x 3 fuels x 4 mileage points).

Emission rates as a function of fuel are presented in tables entitled "Fuel Comparisons." Each value in these tables represented an average of 8 tests (2 duplications x 4 mileage points) or 16 tests when comparing the average of two fuels against a third. The emission rates for fuels 2 and 3 are grouped together when comparing the emission rates of sulfur containing pollutants. Fuels 2 and 3 have a similar sulfur content of 0.03 weight percent, while fuel 1 has less than 0.003 weight percent sulfur. The emission rates for fuels 1 and 2 are grouped together when comparing emission rates of non-sulfur containing pollutants. Fuels 1 and 2 are identical with the exception of sulfur content. Fuel comparisons for only the FTP test cycle are presented when they represent trends typical of the other three driving cycles. When emission rates for the three fuels are similar, the fuel comparison table is omitted.

A comparison of the emission rates with respect to increasing mileage is presented in tables entitled "Mileage Comparisons." Each value in the table represents an average of 6 tests (2 duplications x 3 fuels). As is the case for fuel comparisons, mileage comparisons for only the FTP test cycle are presented when typical of the other three driving cycles. When random or equivalent emission rates are obtained, the mileage comparison tables are omitted.

A comparison of the emission rates with respect to cold or hot start operation is presented in tables entitled "FTP Test Cycle Evaluations." When available the emission rates for each segment of the cold or hot UDSS will be presented and discussed. Each value in the FTP test cycle evaluation tables represents the average of 24 tests (2 duplications x 3 fuels x 4 mileage points).

A discussion pertaining to the toxic effects of each regulated and unregulated pollutant will be included with the emission rate comparisons. When applicable, a comparison the Threshold Limit Value (TLV) for exposure in an 8-hour work shift as established by OSHA<sup>(7)</sup> and/or the 1976 American Conference of Governmental Industrial Hygienists<sup>(8)</sup> will be made with the undiluted (i.e. raw) exhaust concentrations of the pollutant in question. While this comparison does not necessarily provide a means of determining the toxicity of an unregulated pollutant in exhaust, it does provide a means of comparison when presenting the emission rates. Similar comparisons have been made in the evaluation of emissions from malfunctioning automobiles.<sup>(9,10)</sup>

A discussion follows for each regulated and unregulated pollutant evaluated in this project as well as a discussion for raw exhaust oxygen levels, fuel consumption, carbon dioxide emission rates and sulfur balance (i.e., does the total sulfur emission rate equal the sulfur consumed in the fuel).

#### REGULATED EMISSIONS

The average emission rates for the regulated emissions, total hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NO<sub>x</sub>) are listed in Table 9. As shown in the table, except for the HC for the Sunbird, the

TABLE 9. VEHICLE AND TEST CYCLE COMPARISONS  
FOR REGULATED EMISSIONS

| Vehicle            | FTP          | Emission Rates (g/km) |      |      |       |
|--------------------|--------------|-----------------------|------|------|-------|
|                    | Emission Std |                       |      |      |       |
|                    | (g/km)       | FTP                   | SET  | HFET | NYCC  |
| Total Hydrocarbons |              |                       |      |      |       |
| Pinto              | 0.25         | 0.21                  | 0.04 | 0.02 | 0.30  |
| Sunbird            | 0.25         | 0.31*                 | 0.05 | 0.04 | 0.12  |
| Saab               | 0.25         | 0.13                  | 0.03 | 0.03 | 0.08  |
| Marquis            | 0.93         | 0.19                  | 0.06 | 0.03 | 0.36  |
| MDV (g/km)         |              | 0.01                  | 0.01 | 0.01 | 0.03  |
| Carbon Monoxide    |              |                       |      |      |       |
| Pinto              | 5.59         | 2.64                  | 0.17 | 0.05 | 1.67  |
| Sunbird            | 5.59         | 4.92*                 | 0.83 | 0.57 | 2.43* |
| Saab               | 5.59         | 2.00                  | 0.94 | 0.90 | 2.63  |
| Marquis            | 9.32         | 1.08                  | 0.24 | 0.13 | 1.17  |
| MDV (g/km)         |              | 0.04                  | 0.02 | 0.02 | 0.11  |
| NO <sub>x</sub>    |              |                       |      |      |       |
| Pinto              | 0.93         | 0.46                  | 0.64 | 0.68 | 0.50  |
| Sunbird            | 0.93         | 0.74                  | 0.56 | 0.49 | 0.88  |
| Saab               | 0.93         | 0.41                  | 0.50 | 0.55 | 0.41  |
| Marquis            | 1.24         | 0.89                  | 1.14 | 1.05 | 0.93  |
| MDV (g/km)         |              | 0.02                  | 0.01 | 0.01 | 0.04  |

\* Emission rate for fuel #1 at first 5000 mile accumulation omitted from average, oxygen sensor replaced before testing with fuels 2 and 3.

vehicles meet the FTP standards for which they are designed. The Pinto, Sunbird, and Saab were designed to meet the 1978 California Emission Standard while the Marquis was designed to meet the 1979 Federal Emissions Standards. The Saab also meets the 1983 emission standard of 0.25 g/km HC, 2.11 g/km CO, and 0.62 g/km NO<sub>x</sub>. The minimum detection values (MDV) are listed in Table 9 for each test cycle and emission.

The average HC emission rates are lower for the SET and HFET test cycles than for the FTP and NYCC test cycles. All four vehicles have similar HC emission rates for the SET and HFET test cycles (0.02-0.06 g/km) with the largest difference equal to four times the MDV. The Pinto and Marquis (both have a three-way catalyst followed by an oxidation catalyst with auxiliary air injected between the catalysts) have similar HC emission rates for the FTP and NYCC test cycles while the Sunbird and Saab (three-way catalysts only) have similar HC emission rates for the NYCC test cycle. The FTP HC emission rates for the Sunbird and Saab, however, are not similar and differ by 18 times the MDV.

As is the case for the HC emission rates, the CO emission rates are lower for the SET and HFET test cycles. The SET and HFET CO emission rates are lower for the Pinto and Marquis than for the Sunbird and Saab. This trend is reversed for the NYCC with the Sunbird and Saab having lower CO emission rates than the Pinto and Marquis. The FTP CO emission rates are distinct for each vehicle.

The NO<sub>x</sub> emission rates for the Pinto, Saab, and Marquis are higher for the SET and HFET test cycles than for the FTP and NYCC test cycles. The reverse is true for the Sunbird NO<sub>x</sub> emission rates (i.e., the FTP and NYCC emission rates are higher than the SET and HFET emission rates.) The NO<sub>x</sub> emission rates are lowest for the Saab and highest for the Marquis.

The average HC emission rate for each of the three fuels did not differ from the overall HC emission rate by more than  $\pm 0.02$  g/km for the FTP, SET, and HFET test cycles (Table 10). For the NYCC test cycle, the average HC emission rate for the Marquis was higher for fuels 1 and 2 than for fuel 3, while the average HC emission rate for the Pinto was higher for fuel 3 than for fuels 1 and 2 (Table 10). A comparison of the CO and NO<sub>x</sub> emission rates according to fuel is presented in Table 10. The three fuels give similar CO emission rates for the Pinto in the FTP, SET, and HFET test cycles; however, a significant difference is detected between fuels 1 and 2 and fuel 3 in the NYCC test cycles (Table 10). The Saab and Marquis have higher CO emission rates with fuels 1 and 2 than with fuel 3 for all four test cycles (Marquis HFET is an exception - see Table 10) while the Sunbird has higher CO emission rates with fuel 3 for all four test cycles.

The Pinto, Sunbird, and Marquis NO<sub>x</sub> emission rates are higher for all four test cycles when using fuels 1 and 2 than when using fuel 3. The Saab NO<sub>x</sub> emission rates are reversed with fuel 3 giving higher emission rates than fuels 1 or 2 in all four test cycles.

TABLE 10. FUEL COMPARISONS FOR REGULATED EMISSIONS

| Vehicle         | Test Cycle | Emission Rates (g/km) |        |
|-----------------|------------|-----------------------|--------|
|                 |            | Avg. Fuels 1&2        | Fuel 3 |
| Hydrocrabons    |            |                       |        |
| Pinto           | FTP        | 0.21                  | 0.22   |
| Sunbird         | FTP        | 0.32                  | 0.30   |
| Saab            | FTP        | 0.14                  | 0.13   |
| Marquis         | FTP        | 0.20                  | 0.18   |
| Pinto           | SET        | 0.04                  | 0.05   |
| Sunbird         | SET        | 0.05                  | 0.05   |
| Saab            | SET        | 0.03                  | 0.03   |
| Marquis         | SET        | 0.06                  | 0.06   |
| Pinto           | HFET       | 0.02                  | 0.02   |
| Sunbird         | HFET       | 0.03                  | 0.05   |
| Saab            | HFET       | 0.03                  | 0.03   |
| Marquis         | HFET       | 0.03                  | 0.04   |
| Pinto           | NYCC       | 0.22                  | 0.49   |
| Sunbird         | NYCC       | 0.13                  | 0.10   |
| Saab            | NYCC       | 0.08                  | 0.07   |
| Marquis         | NYCC       | 0.39                  | 0.31   |
| Carbon Monoxide |            |                       |        |
| Pinto           | FTP        | 2.64                  | 2.66   |
| Sunbird         | FTP        | 4.82*                 | 5.09   |
| Saab            | FTP        | 2.07                  | 1.87   |
| Marquis         | FTP        | 1.17                  | 0.93   |
| Pinto           | SET        | 0.17                  | 0.16   |
| Sunbird         | SET        | 0.76                  | 0.97   |
| Saab            | SET        | 1.03                  | 0.77   |
| Marquis         | SET        | 0.25                  | 0.21   |
| Pinto           | HFET       | 0.05                  | 0.05   |
| Sunbird         | HFET       | 0.45                  | 0.81   |
| Saab            | HFET       | 1.04                  | 0.63   |
| Marquis         | HFET       | 0.05                  | 0.28   |
| Pinto           | NYCC       | 0.99                  | 3.05   |
| Sunbird         | NYCC       | 2.31                  | 2.68   |
| Saab            | NYCC       | 2.88                  | 2.14   |
| Marquis         | NYCC       | 1.28                  | 0.97   |

\* Emission rate for fuel #1 at first 5000 mile accumulation omitted from average, oxygen sensor replaced before testing with fuels 2 and 3.

TABLE 10 (Cont'd). FUEL COMPARISONS FOR REGULATED EMISSIONS

| Vehicle         | Test Cycle | Emission Rates (g/km) |        |
|-----------------|------------|-----------------------|--------|
|                 |            | Avg. Fuels 1&2        | Fuel 3 |
| NO <sub>x</sub> |            |                       |        |
| Pinto           | FTP        | 0.48                  | 0.43   |
| Sunbird         | FTP        | 0.79                  | 0.64   |
| Saab            | FTP        | 0.40                  | 0.44   |
| Marquis         | FTP        | 0.95                  | 0.80   |
| Pinto           | SET        | 0.65                  | 0.62   |
| Sunbird         | SET        | 0.64                  | 0.42   |
| Saab            | SET        | 0.47                  | 0.56   |
| Marquis         | SET        | 1.24                  | 0.94   |
| Pinto           | HFET       | 0.70                  | 0.64   |
| Sunbird         | HFET       | 0.57                  | 0.32   |
| Saab            | HFET       | 0.53                  | 0.61   |
| Marquis         | HFET       | 1.24                  | 0.68   |
| Pinto           | NYCC       | 0.60                  | 0.57   |
| Sunbird         | NYCC       | 0.93                  | 0.79   |
| Saab            | NYCC       | 0.39                  | 0.45   |
| Marquis         | NYCC       | 0.97                  | 0.85   |

\* Emission rate for fuel #1 at first 5000 mile accumulation omitted from average, oxygen sensor replaced before testing with fuels 2 and 3.



Table 11 lists the average emission rates at each of the four mileage test points. Despite the scatter in some of the test points, there is a noticeable increase in HC and CO emission rates with increasing mileage for the Pinto, Sunbird, and Marquis. The oxygen sensor was replaced on the Sunbird after testing with fuel 1 at the first 5000 mile accumulation test point. The decrease in CO emission rate from the initial to the first mileage accumulation test point may be due to this change. There is a continuous increase in HC and CO emission rates after this change. The Pinto and Marquis HC and CO emission rates, while not showing a continuous increase with mileage, do show an increase from the initial to the final test point. The HC and CO emission rates for the Pinto NYCC test cycle are not similar to the other three test cycles and show an increase in emission rate from the initial to the first mileage accumulation test point followed by a decrease in emission rate at the final two test points. The HC and CO emission rates for the Saab show a significant decrease from the initial test point to the first mileage accumulation test point followed by a gradual increase with mileage after the first mileage accumulation test point. This trend occurred with all four test cycles and is shown in Table 11.

The NO<sub>x</sub> emission rates did not show a trend for the Pinto and Sunbird as emission rates went up and down with increasing mileage. The Marquis FTP test cycle showed an overall increase in NO<sub>x</sub> emission rates, however, the other three test cycles gave random NO<sub>x</sub> emission rates. The Saab, which had low initial NO<sub>x</sub> emission rates (0.10 g/km), showed a 6 to 7 fold increase in NO<sub>x</sub> emission rates from the initial to the final test point for all four test cycles.

Table 12 lists the average emission rates in g/km for each segment of the four segment FTP. The cold start 505 (sec) segment gives a higher emission rate than the other three segments of the FTP test cycles for all three regulated emissions. The cold start 505 emission rates exceed the hot start 505 emission rates by a factor of 2-7 for HC, 4-10 for CO, and 1-2 for NO<sub>x</sub>. In general, the hot start 505 segment gives the second highest emission for the four segment FTP test cycle followed interchangeably by the cold and hot start stabilize 867 (sec) segments. The average cold start stabilize 867 segment does not differ from the hot start stabilize 867 segment by more than 0.02 g/km for HC and NO<sub>x</sub>. The average Pinto, Saab, and Marquis CO emission rates, however do differ appreciably for these two segments. These differences range from 0.01 g/km for the Marquis to 0.27 g/km for the Pinto. The Saab cold start stabilize 867 CO emission rates were consistently higher than the hot start stabilize 867 CO emission rates, however the differences in the two stabilize segments for the Pinto and Marquis were found to be for the most part due to the results in 6 and 2 tests respectively. If the results of these tests were disregarded then the CO emission rate difference between the two stabilize segments would be no more than 0.03 g/km for the Pinto and 0.01 g/km for the Marquis. The average FTP emission rates in Table 9 are from the three bag calculations (does not include the hot start stabilize 867 segment - See Section 2). The average FTP emission rates from the four bag calculation (includes hot start stabilize 867 segment) were found to differ by no more than 0.01 g/km for HC and NO<sub>x</sub>.

TABLE 11. MILEAGE COMPARISONS FOR REGULATED EMISSIONS

|                    |            | Emission Rates (g/km) |                                |                                 |                                |
|--------------------|------------|-----------------------|--------------------------------|---------------------------------|--------------------------------|
| Vehicle            | Test Cycle |                       |                                |                                 |                                |
|                    |            | Initial               | After First<br>5000 Mile Accum | After Second<br>5000 Mile Accum | After Third<br>5000 Mile Accum |
| Total Hydrocarbons |            |                       |                                |                                 |                                |
| Pinto              | FTP        | 0.16                  | 0.20                           | 0.26                            | 0.23                           |
| Sunbird            | FTP        | 0.27                  | 0.27*                          | 0.31                            | 0.38                           |
| Saab               | FTP        | 0.13                  | 0.11                           | 0.15                            | 0.14                           |
| Marquis            | FTP        | 0.14                  | 0.21                           | 0.20                            | 0.23                           |
| Pinto              | SET        | 0.02                  | 0.02                           | 0.06                            | 0.05                           |
| Sunbird            | SET        | 0.03                  | 0.04                           | 0.05                            | 0.07                           |
| Saab               | SET        | 0.05                  | 0.01                           | 0.02                            | 0.03                           |
| Marquis            | SET        | 0.03                  | 0.07                           | 0.07                            | 0.08                           |
| Pinto              | HFET       | 0.01                  | 0.01                           | 0.03                            | 0.03                           |
| Sunbird            | HFET       | 0.02                  | 0.02                           | 0.04                            | 0.05                           |
| Saab               | HFET       | 0.05                  | 0.02                           | 0.02                            | 0.02                           |
| Marquis            | HFET       | 0.01                  | 0.04                           | 0.03                            | 0.04                           |
| Pinto              | NYCC       | 0.32                  | 0.42                           | 0.29                            | 0.18                           |
| Sunbird            | NYCC       | 0.06                  | 0.10                           | 0.15                            | 0.15                           |
| Saab               | NYCC       | 0.09                  | 0.05                           | 0.08                            | 0.08                           |
| Marquis            | NYCC       | 0.28                  | 0.39                           | 0.34                            | 0.43                           |
| Carbon Monoxide    |            |                       |                                |                                 |                                |
| Pinto              | FTP        | 2.15                  | 3.00                           | 2.71                            | 2.72                           |
| Sunbird            | FTP        | 6.06                  | 3.75                           | 4.31                            | 5.17                           |
| Saab               | FTP        | 2.36                  | 1.42                           | 1.89                            | 2.34                           |
| Marquis            | FTP        | 1.00                  | 0.87                           | 1.12                            | 1.34                           |
| Pinto              | SET        | 0.16                  | 0.19                           | 0.16                            | 0.16                           |
| Sunbird            | SET        | 0.32                  | 0.84                           | 1.11                            | 1.04                           |
| Saab               | SET        | 2.17                  | 0.40                           | 0.57                            | 0.62                           |
| Marquis            | SET        | 0.23                  | 0.22                           | 0.24                            | 0.25                           |
| Pinto              | HFET       | 0.06                  | 0.05                           | 0.04                            | 0.04                           |
| Sunbird            | HFET       | 0.24                  | 0.49                           | 0.78                            | 0.75                           |
| Saab               | HFET       | 2.66                  | 0.36                           | 0.28                            | 0.30                           |
| Marquis            | HFET       | 0.07                  | 0.25                           | 0.10                            | 0.09                           |
| Pinto              | NYCC       | 2.19                  | 2.95                           | 1.01                            | 0.54                           |
| Sunbird            | NYCC       | 2.12                  | 1.64                           | 4.81                            | 1.07                           |
| Saab               | NYCC       | 3.35                  | 1.20                           | 2.97                            | 3.01                           |
| Marquis            | NYCC       | 1.36                  | 1.25                           | 0.86                            | 1.22                           |

\* Emission rate for fuel #1 omitted from average, oxygen sensor replaced before testing with fuels 2 and 3.

TABLE 11 (Cont'd). MILEAGE COMPARISONS FOR REGULATED EMISSIONS

|                 |            | Emission Rates (g/km) |                                |                                 |                                |
|-----------------|------------|-----------------------|--------------------------------|---------------------------------|--------------------------------|
| Vehicle         | Test Cycle | Initial               | After First<br>5000 Mile Accum | After Second<br>5000 Mile Accum | After Third<br>5000 Mile Accum |
|                 |            |                       |                                |                                 |                                |
| NO <sub>x</sub> |            |                       |                                |                                 |                                |
| Pinto           | FTP        | 0.55                  | 0.41                           | 0.48                            | 0.41                           |
| Sunbird         | FTP        | 0.80                  | 0.58                           | 0.62                            | 0.94                           |
| Saab            | FTP        | 0.10                  | 0.35                           | 0.52                            | 0.67                           |
| Marquis         | FTP        | 0.75                  | 0.81                           | 1.01                            | 1.01                           |
| Pinto           | SET        | 0.73                  | 0.55                           | 0.68                            | 0.60                           |
| Sunbird         | SET        | 0.83                  | 0.41                           | 0.40                            | 0.60                           |
| Saab            | SET        | 0.08                  | 0.38                           | 0.65                            | 0.88                           |
| Marquis         | SET        | 1.21                  | 0.81                           | 1.13                            | 1.39                           |
| Pinto           | HFET       | 0.83                  | 0.56                           | 0.72                            | 0.59                           |
| Sunbird         | HFET       | 0.78                  | 0.32                           | 0.38                            | 0.49                           |
| Saab            | HFET       | 0.08                  | 0.34                           | 0.74                            | 1.04                           |
| Marquis         | HFET       | 1.20                  | 0.66                           | 1.05                            | 1.30                           |
| Pinto           | NYCC       | 0.55                  | 0.55                           | 0.64                            | 0.61                           |
| Sunbird         | NYCC       | 0.96                  | 0.61                           | 0.69                            | 1.26                           |
| Saab            | NYCC       | 0.09                  | 0.35                           | 0.59                            | 0.59                           |
| Marquis         | NYCC       | 0.67                  | 0.68                           | 1.15                            | 1.21                           |

\* Emission rate for fuel #1 omitted from average, oxygen sensor replaced before testing with fuels 2 and 3.

TABLE 12. FTP TEST CYCLE EVALUATION FOR REGULATED EMISSIONS

| Vehicle            | Emission Rates (g/km) |                             |               |                            |
|--------------------|-----------------------|-----------------------------|---------------|----------------------------|
|                    | Cold Start 505        | Cold Start<br>Stabilize 867 | Hot Start 505 | Hot Start<br>Stabilize 867 |
| Total Hydrocarbons |                       |                             |               |                            |
| Pinto              | 0.62                  | 0.08                        | 0.14          | 0.10                       |
| Sunbird            | 0.98                  | 0.07                        | 0.21          | 0.05                       |
| Saab               | 0.47                  | 0.03                        | 0.07          | 0.02                       |
| Marquis            | 0.34                  | 0.16                        | 0.15          | 0.15                       |
| Carbon Monoxide    |                       |                             |               |                            |
| Pinto              | 10.82                 | 0.26                        | 0.96          | 0.53                       |
| Sunbird            | 16.13                 | 0.71                        | 4.33          | 0.70                       |
| Saab               | 4.74                  | 1.09                        | 1.64          | 0.84                       |
| Marquis            | 3.29                  | 0.34                        | 0.80          | 0.24                       |
| NO <sub>x</sub>    |                       |                             |               |                            |
| Pinto              | 0.69                  | 0.30                        | 0.59          | 0.31                       |
| Sunbird            | 1.26                  | 0.61                        | 0.61          | 0.60                       |
| Saab               | 0.57                  | 0.26                        | 0.57          | 0.27                       |
| Marquis            | 1.43                  | 0.58                        | 1.08          | 0.59                       |

and by no more than 0.08 g/km for CO from the three bag calculation. Table 13 lists the average HC, CO, and NO<sub>x</sub> emission rates for the three and four bag calculations. The emission rates from both the three and four bag calculations are given for each individual test on the computer printout sheets in Appendix D.

Both carbon monoxide (CO) and the oxides of nitrogen (NO<sub>x</sub>) are toxic compounds. The American Conference of Governmental Industrial Hygienists (ACGIH) and OSHA have established TLV values of 50 ppm (58.25 mg/m<sup>3</sup>) for CO and 5 ppm (9.58 mg/m<sup>3</sup>) for nitrogen dioxide (NO<sub>2</sub>) and 25 ppm (31.2 mg/m<sup>3</sup>) for nitric oxide, the major components of NO<sub>x</sub>. Except for the CO Pinto HFET emission rate, all CO emission rates in Table 9 give raw exhaust concentrations that exceed the TLV. The highest average CO raw exhaust concentration was found for the Sunbird FTP test cycle, 4.49 g/m<sup>3</sup> (77 times the TLV). All NO<sub>x</sub> emission rates in Table 9 give raw exhaust concentrations that exceed the nitrogen dioxide TLV by a factor of 22 to 108 and the nitric oxide TLV by a factor of 7 to 33. The Marquis HFET cycle gave the highest average NO<sub>x</sub> raw exhaust concentration, 1.03 g/m<sup>3</sup> (108 times the nitrogen dioxide TLV).

In order to determine the concentrations of CO and NO<sub>x</sub> a commuter on a crowded expressway would experience in a severe case, the CO and NO<sub>x</sub> data were inserted into a model situation described by M. N. Ingalls Jr. and C. T. Hare<sup>(11)</sup>. In this model the severe case is defined as an area having high traffic flow, parallel wind, and neutral stability for a large percentage of the time. The traffic density, wind speed and direction used in this model were actual data from a Houston expressway. The dispersion model used in their study was the Gaussian model developed by D. P. Chock of General Motors. If the highest average CO tailpipe emission rate found in Table 9 is inserted into this model (4.92 g/km), a CO commuter exposure concentration of 3.03 mg/m<sup>3</sup> (0.05 times the TLV) is obtained. This level represents an approximate dilution of 1000 to 1. Insertion of the highest NO<sub>x</sub> emission rate (1.14 g/km) into the model gives a commuter NO<sub>x</sub> exposure level of 0.701 mg/km (0.07 times the nitrogen dioxide TLV).

#### UNREGULATED EMISSIONS

Individual Hydrocarbons (IHC) - The emission rates of eight individual hydrocarbons (IHC), methane, ethylene, ethane, acetylene, propane, propylene, benzene, and toluene were measured in this project. Methane, ethane, acetylene, propane, and benzene are essentially nonreactive hydrocarbons and contribute little to atmospheric oxidant/ozone formation<sup>(12)</sup>. The hydrocarbons that are reactive and participate to varying degrees in oxidant/ozone formation are the C<sub>4</sub><sup>+</sup> paraffins, aromatics (less benzene) and olefins. The measurement of the eight IHC in this project (which includes the five nonreactive hydrocarbons) provides additional information on the environmental significance of the total hydrocarbon emissions in this project. Table 14 lists the average emission rates in mg/km for methane, ethylene, ethane, acetylene, propane, propylene, benzene and toluene as well as the total IHC emission rates for each vehicle and test cycle. The numbers in

TABLE 13. A COMPARISON OF AVERAGE EMISSION RATES FROM THE THREE AND FOUR BAG CALCULATIONS FOR THE REGULATED EMISSIONS

| Vehicle         | Emission Rates (g/km) |                      |
|-----------------|-----------------------|----------------------|
|                 | Three Bag Calculation | Four Bag Calculation |
| HC              |                       |                      |
| Pinto           | 0.21                  | 0.21                 |
| Sunbird         | 0.31                  | 0.30                 |
| Saab            | 0.13                  | 0.13                 |
| Marquis         | 0.19                  | 0.19                 |
| CO              |                       |                      |
| Pinto*          | 2.64                  | 2.72                 |
| Sunbird         | 4.92                  | 4.91                 |
| Saab            | 2.00                  | 1.92                 |
| Marquis**       | 1.08                  | 1.05                 |
| NO <sub>x</sub> |                       |                      |
| Pinto           | 0.46                  | 0.46                 |
| Sunbird         | 0.74                  | 0.74                 |
| Saab            | 0.41                  | 0.41                 |
| Marquis         | 0.89                  | 0.89                 |

\* If the results from six tests are disregarded then the averages are 2.63 g/km (3 bag) and 2.64 g/km (4 bag)

\*\*If the results from two tests are disregarded then the averages are 1.05 g/km (3 bag) and 1.04 g/km (4 bag)



TABLE 14. VEHICLE AND TEST CYCLE COMPARISONS  
FOR INDIVIDUAL HYDROCARBONS

| Individual<br>Hydrocarbons       | Emission Rates (mg/km) |            |            |             |
|----------------------------------|------------------------|------------|------------|-------------|
|                                  | FTP                    | SET        | HFET       | NYCC        |
| Pinto                            |                        |            |            |             |
| Methane                          | 53.26 (25) *           | 21.04 (53) | 11.30 (57) | 121.38 (40) |
| Ethylene                         | 11.56 (6)              | 0.37 (1)   | 0.10 (1)   | 11.65 (4)   |
| Ethane                           | 7.38 (4)               | 2.32 (6)   | 1.06 (5)   | 18.34 (6)   |
| Acetylene                        | 4.43 (2)               | ND         | ND         | ND          |
| Propane                          | 1.15 (1)               | 0.11       | 0.24 (1)   | 3.39 (1)    |
| Propylene                        | 4.12 (2)               | 0.01       | 0.01       | 1.72 (1)    |
| Benzene                          | 9.34 (4)               | 0.30 (1)   | 0.13 (1)   | 6.41 (2)    |
| Toluene                          | 11.05 (5)              | 0.02       | <0.01      | 0.55        |
| Total Individual<br>Hydrocarbons | 102.29 (49)            | 24.17 (60) | 12.84 (64) | 163.44 (54) |
| Sunbird                          |                        |            |            |             |
| Methane                          | 43.12 (14)             | 20.21 (40) | 15.49 (39) | 45.84 (38)  |
| Ethylene                         | 23.37 (8)              | 2.11 (4)   | 1.35 (3)   | 5.55 (5)    |
| Ethane                           | 6.48 (2)               | 3.13 (6)   | 2.42 (6)   | 6.87 (6)    |
| Acetylene                        | 10.25 (3)              | ND         | ND         | ND          |
| Propane                          | 1.26                   | 0.09       | 0.07       | 0.84 (1)    |
| Propylene                        | 11.08 (4)              | 0.57 (1)   | 0.46 (1)   | 0.77 (1)    |
| Benzene                          | 23.40 (8)              | 2.64 (5)   | 1.48 (4)   | 8.30 (7)    |
| Toluene                          | 22.38 (7)              | 0.44 (1)   | 0.15       | 0.52        |
| Total Individual<br>Hydrocarbons | 141.34 (46)            | 29.19 (58) | 21.42 (54) | 68.69 (57)  |

\* Numbers in parentheses represent percent of total hydrocarbons.

TABLE 14 (Cont'd). VEHICLE AND TEST CYCLE COMPARISONS  
FOR INDIVIDUAL HYDROCARBONS

| Individual<br>Hydrocarbons       | Emission Rates (mg/km) |            |            |             |
|----------------------------------|------------------------|------------|------------|-------------|
|                                  | FTP                    | SET        | HFET       | NYCC        |
| Saab                             |                        |            |            |             |
| Methane                          | 20.92 (16)             | 8.73 (29)  | 6.65 (22)  | 46.57 (58)  |
| Ethylene                         | 9.08 (7)               | 2.23 (7)   | 2.29 (8)   | 2.48 (3)    |
| Ethane                           | 2.57 (2)               | 1.03 (3)   | 0.93 (3)   | 4.18 (5)    |
| Acetylene                        | 2.31 (2)               | 0.15       | 0.13       | ND          |
| Propane                          | 0.21                   | 0.28 (1)   | 1.43 (5)   | 7.87 (9)    |
| Propylene                        | 4.65 (4)               | 1.33 (4)   | 1.33 (4)   | 0.57 (1)    |
| Benzene                          | 8.70 (7)               | 2.53 (8)   | 2.97 (10)  | 5.77 (7)    |
| Toluene                          | 10.27 (8)              | 1.67 (6)   | 1.75 (6)   | 1.96 (2)    |
| Total Individual<br>Hydrocarbons | 58.71 (45)             | 17.95 (60) | 17.48 (58) | 69.40 (87)  |
| Marquis                          |                        |            |            |             |
| Methane                          | 64.63 (32)             | 29.51 (49) | 14.85 (50) | 150.57 (42) |
| Ethylene                         | 4.97 (2)               | 0.56 (1)   | 0.28 (1)   | 5.33 (1)    |
| Ethane                           | 8.29 (4)               | 3.64 (6)   | 1.74 (6)   | 21.17 (6)   |
| Acetylene                        | 1.35 (1)               | ND         | ND         | ND          |
| Propane                          | 0.52                   | 0.24       | 0.14       | 2.83 (1)    |
| Propylene                        | 1.66                   | ND         | 0.07       | 0.93        |
| Benzene                          | 6.53 (2)               | 0.91 (2)   | 0.40 (1)   | 7.00 (2)    |
| Toluene                          | 5.21 (3)               | 0.06       | 0.02       | 0.77        |
| Total Individual<br>Hydrocarbons | 93.16 (47)             | 34.92 (58) | 17.50 (58) | 188.60 (52) |
| MDV (mg/km)                      | 0.50                   | 0.30       | 0.20       | 1.40        |

\* Numbers in parentheses represent percent of total hydrocarbons

parentheses in the table represent the fractional percent of the total hydrocarbons emitted from a particular vehicle and test cycle for each IHC. The MDV are the same for all eight IHC and are listed at the bottom of Table 14.

The emission rates for the IHC are directly related to the HC emission rates and a discussion of relative amounts would parallel trends discussed for the HC. The percent that each IHC component comprises of the total HC, however, does reveal additional trends. Methane comprises a larger percent of the HC in the SET and HFET test cycles than in the FTP and NYCC test cycles (the one exception is the Saab NYCC test cycle). The eight IHC comprise 54 to 64 percent of the total HC in the SET and HFET test cycles for all four vehicles. For the most part this percentage is made up of methane and ethane for the Pinto and the Marquis. The Sunbird and Saab, however, have significant percentages of several of the other IHC including ethylene, propane (Saab), propylene (Saab), benzene, and toluene (Saab). These five IHC comprise from 9 to 33 percent of the total hydrocarbons from the Sunbird and Saab while only 2 to 3 percent of the total hydrocarbons from the Pinto and Marquis. A similar trend is found for the FTP test cycle. The eight IHC compounds make up from 45 to 49 percent of the total HC for all four vehicles; however, the breakdown of this 45 to 49 percent varies for each vehicle. Methane and ethane make up 36 percent of the total HC for the Marquis; while the other six IHC make up only 11 percent of the total HC. These other six IHC components make up a much larger percent of the total HC from the Sunbird (30 percent) and Saab (28 percent), while methane and ethane make up a smaller percentage of the total HC (16 percent for the Sunbird and 18 percent for the Saab). The FTP IHC emission rates for the Pinto fall between those of the Marquis and Sunbird - Saab. The IHC emission rate trends for NYCC test cycles are similar to those for the FTP except for the comparatively high percentage of methane from the Saab.

The five nonreactive hydrocarbons, methane, ethane, acetylene, propane and benzene comprise 27 to 80 percent of the total hydrocarbons from three-way catalyst systems depending on the test cycle and vehicle (Figure 4). The FTP which contains a cold start has a lower percentage of the nonreactive hydrocarbons than the three hot start test cycles.

A comparison of the IHC emission rates as to fuel is presented in Table 15. Fuels 1 and 2 give lower relative amounts and percentages of methane, ethane, and propylene and to some degree ethylene than does fuel 3. Fuels 1 and 2 do give higher emission rates and percentages of benzene and toluene. These differences in emission rates for the IHC according to fuel may be due to the higher aromatic content of fuels 1 and 2 compared to fuel 3 (Table 2).

The IHC emission rates follow the same trends with increasing mileage as do the total HC (i.e., increasing IHC with increasing mileage). The emission rates and the percent of the total hydrocarbon emission rate from

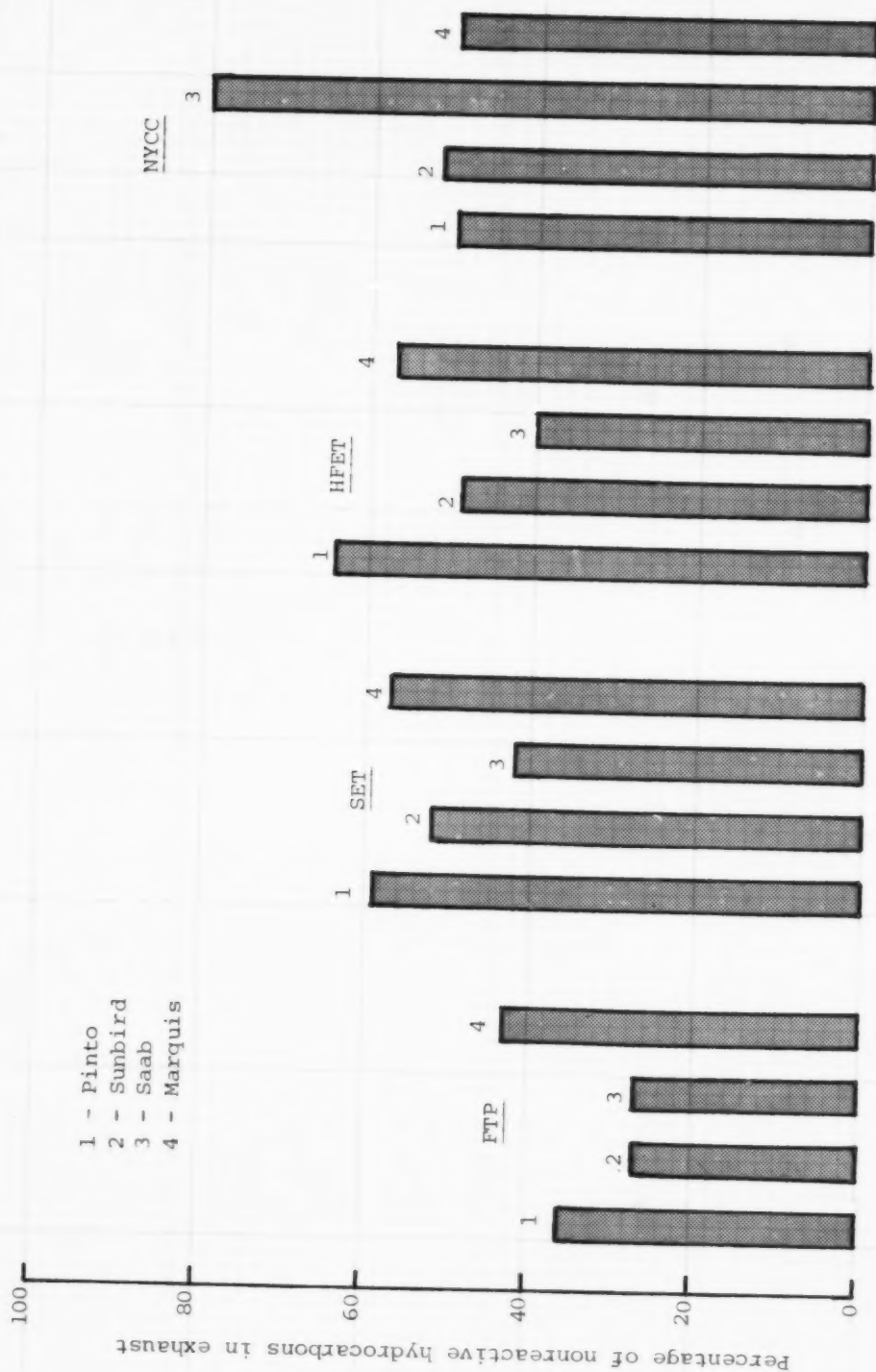


Figure 4. Percentages of the nonreactive hydrocarbons for the four test vehicles operating over the four test cycles.

TABLE 15. FUEL COMPARISONS FOR INDIVIDUAL HYDROCARBONS

| Vehicle   | Test Cycle | Emission Rates (mg/km) |            |
|-----------|------------|------------------------|------------|
|           |            | Avg. Fuel 1&2          | Fuel 3     |
| Methane   |            |                        |            |
| Pinto     | FTP        | 45.38 (22) *           | 69.02 (31) |
| Sunbird   | FTP        | 40.01 (13)             | 48.49 (16) |
| Saab      | FTP        | 19.71 (15)             | 23.34 (18) |
| Marquis   | FTP        | 66.20 (31)             | 69.48 (39) |
| Ethylene  |            |                        |            |
| Pinto     | FTP        | 10.64 (5)              | 13.44 (6)  |
| Sunbird   | FTP        | 22.08 (7)              | 25.42 (8)  |
| Saab      | FTP        | 9.92 (6)               | 9.39 (7)   |
| Marquis   | FTP        | 5.33 (3)               | 4.27 (2)   |
| Ethane    |            |                        |            |
| Pinto     | FTP        | 6.41 (3)               | 10.93 (5)  |
| Sunbird   | FTP        | 5.89 (2)               | 7.52 (3)   |
| Saab      | FTP        | 2.44 (2)               | 2.84 (2)   |
| Marquis   | FTP        | 7.65 (4)               | 9.54 (5)   |
| Propylene |            |                        |            |
| Pinto     | FTP        | 3.80 (2)               | 4.87 (2)   |
| Sunbird   | FTP        | 10.28 (3)              | 12.60 (4)  |
| Saab      | FTP        | 4.42 (3)               | 5.12 (4)   |
| Marquis   | FTP        | 1.55 (1)               | 1.87 (1)   |
| Benzene   |            |                        |            |
| Pinto     | FTP        | 11.65 (6)              | 4.73 (2)   |
| Sunbird   | FTP        | 31.86 (10)             | 9.48 (3)   |
| Saab      | FTP        | 11.08 (8)              | 3.98 (3)   |
| Marquis   | FTP        | 8.87 (4)               | 1.85 (1)   |
| Toluene   |            |                        |            |
| Pinto     | FTP        | 15.04 (7)              | 3.09 (1)   |
| Sunbird   | FTP        | 30.18 (9)              | 7.90 (3)   |
| Saab      | FTP        | 13.47 (10)             | 3.87 (3)   |
| Marquis   | FTP        | 7.34 (3)               | 0.98 (1)   |

\* Numbers in parentheses represent percent of total hydrocarbons

the FTP and SET test cycles for methane, ethylene, acetylene, propylene, benzene and toluene at the four mileage test points are shown in Table 16. The other two IHC either follow the total HC trend with mileage or give erratic results. There is a significant decrease in the methane as a percentage of the total HC emission rate for the initial test point to the final mileage accumulation test point for the Pinto and Marquis. This drop-off occurs at different mileage accumulation test points for the different test cycles. The percent methane from the Sunbird shows no overall drop with one test cycle increasing and another decreasing. The methane emission rates for the Saab follow the same trends as do the total HC; a significant decrease in the emission rate from the initial test point to the first mileage accumulation test point followed by a gradual increase in emission rate for the following mileage test points. The methane as a percentage of the total HC, however, increases from the initial test point to the first mileage accumulation test point and decreased thereafter. This trend was observed for all four test cycles. The ethylene, acetylene, and propylene emission rates in general follow the total HC trend with mileage. The benzene emission rates as well as the percentage of the total HC were found to increase with increasing mileage. The toluene emission rates and percentages show the opposite trend and decrease with increasing mileage.

Table 17 lists the average IHC dilute exhaust concentrations in ppmC for each segment of the FTP. The numbers in parentheses represent the fractional percent of the dilute exhaust total hydrocarbon concentration (ppmC) from a particular vehicle and FTP segment for each IHC. A breakdown of the IHC emission rates in mg/km for each segment of the FTP test cycle was not available for the report, however, the dilute exhaust ppmC concentrations (found in Appendix C) provide similar data for comparison. As was the case for the total HC, the relative concentrations of each IHC are highest in the cold start 505 segment. The hot start 505 segment has relative concentrations higher than either the cold or hot start stabilize 867 segments. In general, the percentages of ethylene, acetylene, propylene, benzene (Pinto and Marquis only), and toluene follow the same trend with the cold start 505 segment percentages > hot start 505 segment percentages > cold start stabilize 867 segment percentages  $\approx$  hot start stabilize 867 segment percentages. The methane and ethane percentages give the reverse trend with the cold and hot start stabilize 866 segments giving the highest percentages of methane and ethane. As was the case for the FTP, SET, HFET, and NYCC test cycles, the Pinto and Marquis FTP test segments in general give the highest percentages of methane and ethane and the lowest percentages of the remaining six IHC.

While benzene is not participant in atmospheric reactions, it is toxic and the American Conference of Governmental Industrial Hygienists (ACGIH) has established a 10 ppm (32 mg/m<sup>3</sup>) TLV for exposure in an 8-hour work shift. The highest undiluted benzene emission rates are found for the FTP test cycle and range from 4.29 mg/m<sup>3</sup> (0.1 times the TLV) for the Marquis to 22.37 mg/m<sup>3</sup> (0.7 times the TLV) for the Sunbird. The comparisons to the TLV are made only to give some insight as to the relative significance of the measurement.



TABLE 16. MILEAGE COMPARISONS FOR INDIVIDUAL HYDROCARBONS

| Vehicle   | Test Cycle | Emission Rates (mg/km) |                                |                                 |                                |
|-----------|------------|------------------------|--------------------------------|---------------------------------|--------------------------------|
|           |            | Initial                | After First<br>5000 mile Accum | After Second<br>5000 mile Accum | After Third<br>5000 mile Accum |
| Methane   |            |                        |                                |                                 |                                |
| Pinto     | FTP        | 40.20 (25)*            | 63.26 (32)                     | 59.18 (23)                      | 50.40 (22)                     |
| Sunbird   | FTP        | 29.81 (11)             | 40.36 (15)                     | 45.55 (15)                      | 55.83 (15)                     |
| Saab      | FTP        | 20.16 (16)             | 17.31 (16)                     | 22.00 (15)                      | 24.20 (15)                     |
| Marquis   | FTP        | 56.92 (41)             | 63.56 (30)                     | 68.59 (34)                      | 69.42 (30)                     |
| Pinto     | SET        | 16.47 (82)             | 18.87 (94)                     | 24.29 (40)                      | 24.51 (49)                     |
| Sunbird   | SET        | 13.70 (46)             | 18.01 (45)                     | 22.59 (45)                      | 26.52 (38)                     |
| Saab      | SET        | 13.51 (27)             | 5.59 (56)                      | 7.07 (35)                       | 8.75 (29)                      |
| Marquis   | SET        | 19.78 (66)             | 29.72 (42)                     | 32.78 (47)                      | 35.77 (45)                     |
| Ethylene  |            |                        |                                |                                 |                                |
| Pinto     | FTP        | 9.69 (6)               | 12.76 (6)                      | 12.61 (5)                       | 11.22 (5)                      |
| Sunbird   | FTP        | 23.81 (9)              | 18.96 (7)                      | 18.22 (6)                       | 31.02 (8)                      |
| Saab      | FTP        | 8.46 (7)               | 8.41 (8)                       | 10.02 (7)                       | 9.40 (7)                       |
| Marquis   | FTP        | 3.57 (3)               | 3.91 (2)                       | 4.95 (2)                        | 7.46 (3)                       |
| Pinto     | SET        | 0.48 (2)               | 0.14 (1)                       | 0.31 (1)                        | 0.56 (1)                       |
| Sunbird   | SET        | 0.96 (3)               | 0.92 (2)                       | 2.09 (4)                        | 4.48 (6)                       |
| Saab      | SET        | 3.47 (7)               | 1.82 (18)                      | 1.80 (9)                        | 1.84 (6)                       |
| Marquis   | SET        | 0.23 (1)               | 0.29                           | 0.61 (1)                        | 1.13 (1)                       |
| Acetylene |            |                        |                                |                                 |                                |
| Pinto     | FTP        | 3.61 (2)               | 4.28 (2)                       | 5.38 (2)                        | 4.47 (2)                       |
| Sunbird   | FTP        | 6.38 (2)               | 11.91 (4)                      | 8.02 (3)                        | 15.23 (4)                      |
| Saab      | FTP        | 1.73 (1)               | 2.35 (2)                       | 2.50 (2)                        | 2.65 (2)                       |
| Marquis   | FTP        | 0.79                   | 1.36 (1)                       | 1.74 (1)                        | 1.50 (1)                       |
| Pinto     | SET        | ND                     | ND                             | ND                              | ND                             |
| Sunbird   | SET        | ND                     | ND                             | ND                              | ND                             |
| Saab      | SET        | 0.31 (1)               | 0.16 (1)                       | 0.05                            | 0.06                           |
| Marquis   | SET        | ND                     | ND                             | ND                              | ND                             |

\* Numbers in parentheses represent percent of total hydrocarbons

TABLE 16 (Cont'd). MILEAGE COMPARISONS FOR INDIVIDUAL HYDROCARBONS

|           |            | Emission Rates (mg/km) |                                |                                 |                                |
|-----------|------------|------------------------|--------------------------------|---------------------------------|--------------------------------|
| Vehicle   | Test Cycle |                        |                                |                                 |                                |
|           |            | Initial                | After First<br>5000 Mile Accum | After Second<br>5000 Mile Accum | After Third<br>5000 Mile Accum |
| Propylene |            |                        |                                |                                 |                                |
| Pinto     | FTP        | 3.68 (2)               | 4.01 (2)                       | 4.49 (2)                        | 4.32 (2)                       |
| Sunbird   | FTP        | 11.34 (4)              | 9.58 (4)                       | 10.24 (3)                       | 12.68 (3)                      |
| Saab      | FTP        | 4.44 (3)               | 4.33 (4)                       | 5.13 (3)                        | 4.71 (3)                       |
| Marquis   | FTP        | 1.51 (1)               | 1.37 (1)                       | 1.49 (1)                        | 2.24 (1)                       |
| Pinto     | SET        | 0.02                   | 0.02                           | ND                              | ND                             |
| Sunbird   | SET        | ND                     | 0.10                           | 0.69 (1)                        | 1.48 (2)                       |
| Saab      | SET        | 2.21 (4)               | 1.40 (14)                      | 0.80 (4)                        | 0.93 (3)                       |
| Marquis   | SET        | ND                     | ND                             | <0.01                           | ND                             |
| Benzene   |            |                        |                                |                                 |                                |
| Pinto     | FTP        | 7.25 (5)               | 9.53 (5)                       | 11.06 (4)                       | 9.54 (4)                       |
| Sunbird   | FTP        | 16.58 (6)              | 11.74 (4)                      | 16.58 (5)                       | 44.43 (12)                     |
| Saab      | FTP        | 4.76 (6)               | 5.77 (5)                       | 8.83 (6)                        | 12.47 (9)                      |
| Marquis   | FTP        | 4.37 (3)               | 5.17 (2)                       | 5.50 (3)                        | 11.08 (5)                      |
| Pinto     | SET        | 0.04                   | 0.15 (1)                       | 0.56 (1)                        | 0.43 (1)                       |
| Sunbird   | SET        | 0.64 (2)               | 1.17 (3)                       | 2.23 (4)                        | 6.50 (9)                       |
| Saab      | SET        | 4.61 (9)               | 1.24 (12)                      | 1.73 (9)                        | 1.86 (9)                       |
| Marquis   | SET        | 0.26 (1)               | 0.81 (1)                       | 0.55 (1)                        | 1.68 (2)                       |
| Toluene   |            |                        |                                |                                 |                                |
| Pinto     | FTP        | 9.49 (6)               | 11.58 (6)                      | 12.50 (5)                       | 10.64 (5)                      |
| Sunbird   | FTP        | 21.46 (8)              | 15.04 (6)                      | 26.23 (8)                       | 24.34 (6)                      |
| Saab      | FTP        | 9.80 (8)               | 8.30 (8)                       | 13.32 (9)                       | 9.66 (7)                       |
| Marquis   | FTP        | 4.91 (4)               | 4.26 (2)                       | 5.67 (3)                        | 6.02 (3)                       |
| Pinto     | SET        | 0.03                   | 0.04                           | ND                              | ND                             |
| Sunbird   | SET        | 0.05                   | 0.32 (1)                       | 0.59 (1)                        | 0.80 (1)                       |
| Saab      | SET        | 4.15 (8)               | 0.69 (7)                       | 1.00 (5)                        | 0.86 (3)                       |
| Marquis   | SET        | 0.14                   | 0.14                           | ND                              | ND                             |

\* Numbers in parentheses represent percent of total hydrocarbons

TABLE 17. FTP TEST CYCLE EVALUATION FOR INDIVIDUAL HYDROCARBONS

| Individual Hydrocarbons | Dilute Exhaust Concentration (ppmC) |                          |               |                         |
|-------------------------|-------------------------------------|--------------------------|---------------|-------------------------|
|                         | Cold Start 505                      | Cold Start Stabilize 866 | Hot Start 505 | Hot Start Stabilize 866 |
| Pinto                   |                                     |                          |               |                         |
| Methane                 | 9.16 (11)*                          | 3.10 (44)                | 4.12 (22)     | 3.64 (46)               |
| Ethylene                | 5.40 (7)                            | 0.08 (1)                 | 1.02 (5)      | 0.15 (2)                |
| Ethane                  | 1.23 (2)                            | 0.44 (6)                 | 0.92 (5)      | 0.49 (6)                |
| Acetylene               | 2.97 (4)                            | 0.02                     | <0.01         | <0.01                   |
| Propane                 | 0.21                                | 0.08 (1)                 | 0.14 (1)      | 0.06 (1)                |
| Propylene               | 2.27 (3)                            | <0.01                    | 0.24 (1)      | 0.01                    |
| Benzene                 | 4.73 (6)                            | 0.10 (1)                 | 0.84 (4)      | 0.14 (2)                |
| Toluene                 | 6.85 (8)                            | 0.01                     | 0.46 (2)      | 0.02                    |
| Sunbird                 |                                     |                          |               |                         |
| Methane                 | 10.82 (8)                           | 1.42 (28)                | 4.80 (17)     | 1.36 (34)               |
| Ethylene                | 10.60 (8)                           | 0.25 (5)                 | 2.32 (8)      | 0.17 (4)                |
| Ethane                  | 1.45 (1)                            | 0.32 (6)                 | 0.86 (3)      | 0.30 (8)                |
| Acetylene               | 6.70 (5)                            | 0.01                     | 0.20 (1)      | ND                      |
| Propane                 | 0.24                                | 0.06 (1)                 | 0.15 (1)      | 0.02 (1)                |
| Propylene               | 5.57 (4)                            | 0.02                     | 0.87 (3)      | <0.01                   |
| Benzene                 | 11.14 (8)                           | 0.42 (8)                 | 2.49 (9)      | 0.27 (7)                |
| Toluene                 | 12.08 (9)                           | 0.25 (5)                 | 1.48 (5)      | 0.02 (1)                |
| Saab                    |                                     |                          |               |                         |
| Methane                 | 5.15 (8)                            | 0.68 (34)                | 1.81 (20)     | 0.67 (34)               |
| Ethylene                | 4.59 (7)                            | 0.12 (6)                 | 0.51 (6)      | 0.09 (5)                |
| Ethane                  | 0.96 (2)                            | 0.03 (2)                 | 0.25 (3)      | 0.06 (3)                |
| Acetylene               | 1.51 (2)                            | 0.01 (1)                 | 0.03          | 0.01 (1)                |
| Propane                 | 0.02                                | <0.01                    | 0.02          | 0.03 (2)                |
| Propylene               | 2.45 (4)                            | 0.03 (2)                 | 0.27 (3)      | 0.02 (1)                |
| Benzene                 | 4.43 (7)                            | 0.17 (9)                 | 0.80 (9)      | 0.12 (6)                |
| Toluene                 | 5.91 (10)                           | 0.10 (5)                 | 0.54 (6)      | 0.06 (3)                |
| Marquis                 |                                     |                          |               |                         |
| Methane                 | 7.23 (16)                           | 5.06 (39)                | 4.57 (23)     | 4.97 (41)               |
| Ethylene                | 1.84 (4)                            | 0.15 (1)                 | 0.60 (3)      | 0.10 (1)                |
| Ethane                  | 0.94 (2)                            | 0.65 (5)                 | 0.88 (4)      | 0.64 (5)                |
| Acetylene               | 0.81 (2)                            | 0.01                     | ND            | ND                      |
| Propane                 | 0.13                                | 0.05                     | 0.08          | 0.03                    |
| Propylene               | 0.87 (2)                            | 0.02                     | 0.10 (1)      | ND                      |
| Benzene                 | 2.47 (5)                            | 0.21 (2)                 | 0.96 (5)      | 0.17 (1)                |
| Toluene                 | 2.97 (7)                            | 0.05                     | 0.34 (2)      | 0.01                    |

\* Numbers in parentheses represent percent of total hydrocarbons.

Aldehydes and Ketones - The emission rates of ten aldehydes and ketones; formaldehyde, acetaldehyde, acetone, acrolein, propionaldehyde, isobutyraldehyde, methylethylketone, crotonaldehyde, hexanaldehyde, and benzaldehyde were measured in this project. Acetone, acrolein, and propionaldehyde were not resolved from each other using the normal gas chromatographic operating conditions and all three have been reported together as acetone. The aldehydes and ketones are formed by the partial oxidation of the fuel hydrocarbons. The aldehydes and ketones can cause respiratory problems, are severe eye irritants and are photochemically reactive. TLV values have been established by OSHA and the ACGIH for 6 of the 10 measured aldehydes. These values are 0.1 ppm for acrolein, 2 ppm for formaldehyde and crotonaldehyde, 100 ppm for acetaldehyde, 200 ppm for methylethylketone and 1000 ppm for acetone.

The emission rates of two of the aldehydes, crotonaldehyde and benzaldehyde, could not be measured accurately in this project due to interferences in the analysis procedure. The isobutyraldehyde emission rates determined in this project were higher than expected. These unexpected higher emission rates could be due to undetected interferences. Three other aldehydes and ketones were found in only a small fraction of the samples analyzed. Acetone (sum of acetone, acrolein, and propionaldehyde) was found in 14 percent of the samples, methylethylketone in 18 percent, and hexanaldehyde in 21 percent of the samples. An even smaller percentage of these samples contained aldehyde concentrations which gave emission rates greater than the MDV - 9 percent for acetone, 11 percent for methylethylketone and 17 percent for hexanaldehyde.

Table 18 lists the average emission rates for formaldehyde, acetaldehyde, isobutyraldehyde, acetone, methylethylketone, and hexanaldehyde. The Marquis gave the highest emission rate for formaldehyde in all four test cycles (3.29-3.63 mg/km) followed by the Pinto (0.09-2.79 mg/km), the Sunbird (0.15-1.24 mg/km) and the Saab (0.07-0.88 mg/km). The acetaldehyde emission rates are similar for all four vehicles and do not exceed 3 times the MDV. The aldehyde and ketone emission rates are lowest for the SET and HFET test cycles and highest for the NYCC test cycles.

A comparison of the emission rates as a function of fuel is presented in Table 19. Fuels 1 and 2 give lower emission rates for formaldehyde and acetaldehyde than fuel 3 for the Pinto and Marquis. There is little or no difference in the formaldehyde emission rates due to fuel for the Sunbird and Saab. Table 20 shows the increase in emission rates for formaldehyde, acetaldehyde, and hexanaldehyde with increasing mileage.

A comparison of the emission tests as a function of cold or hot start is presented in Table 21. Formaldehyde and acetaldehyde emission rates are higher in the cold start UDDS segment than in the hot start UDDS segment (1.1-5.5 times higher for formaldehyde and 1.4-2.0 times higher for acetaldehyde).

TABLE 18. VEHICLE AND TEST CYCLE COMPARISONS FOR  
ALDEHYDES AND KETONES

| Vehicle           | Emission Rates (mg/km) |      |      |       |
|-------------------|------------------------|------|------|-------|
|                   | FTP                    | SET  | HFET | NYCC  |
| Formaldehyde      |                        |      |      |       |
| Pinto             | 0.99                   | 1.26 | 1.01 | 2.79  |
| Sunbird           | 0.68                   | 0.15 | 0.18 | 1.24  |
| Saab              | 0.19                   | 0.08 | 0.07 | 0.88  |
| Marquis           | 3.44                   | 3.29 | 3.41 | 3.63  |
| MDV (mg/km)       | 0.10                   | 0.06 | 0.07 | 0.65  |
| Acetaldehyde      |                        |      |      |       |
| Pinto             | 0.18                   | 0.18 | 0.24 | 0.96  |
| Sunbird           | 0.29                   | 0.18 | 0.26 | 1.93  |
| Saab              | 0.40                   | 0.15 | 0.30 | 1.72  |
| Marquis           | 0.40                   | 0.16 | 0.21 | 1.75  |
| MDV (mg/km)       | 0.15                   | 0.08 | 0.11 | 0.96  |
| Isobutyraldehyde  |                        |      |      |       |
| Pinto             | 1.72                   | 0.72 | 0.49 | 12.26 |
| Sunbird           | 1.53                   | 0.96 | 1.54 | 11.49 |
| Saab              | 2.05                   | 1.42 | 2.84 | 21.73 |
| Marquis           | 0.94                   | 0.30 | 0.45 | 19.62 |
| MDV (mg/km)       | 0.25                   | 0.14 | 0.18 | 1.57  |
| Acetone           |                        |      |      |       |
| Pinto             | 0.15                   | 0.06 | 0.10 | 0.17  |
| Sunbird           | 0.06                   | 0.01 | 0.06 | 0.26  |
| Saab              | 0.06                   | 0.01 | 0.07 | ND    |
| Marquis           | 0.07                   | 0.09 | 0.17 | 0.74  |
| MDV (mg/km)       | 0.20                   | 0.11 | 0.14 | 1.25  |
| Methylethylketone |                        |      |      |       |
| Pinto             | 0.03                   | 0.08 | 0.04 | 0.31  |
| Sunbird           | 0.03                   | 0.05 | 0.05 | 0.63  |
| Saab              | 0.15                   | 0.08 | 0.12 | 0.77  |
| Marquis           | 0.01                   | 0.01 | 0.02 | ND    |
| MDV (mg/km)       | 0.25                   | 0.14 | 0.18 | 1.57  |
| Hexanaldehyde     |                        |      |      |       |
| Pinto             | 0.12                   | 0.09 | 0.07 | 0.82  |
| Sunbird           | 0.12                   | 0.06 | 0.06 | 1.39  |
| Saab              | 0.17                   | 0.14 | 0.21 | 1.39  |
| Marquis           | 0.07                   | 0.03 | 0.04 | 0.46  |
| MDV (mg/km)       | 0.35                   | 0.19 | 0.25 | 2.19  |

TABLE 19. FUEL COMPARISONS FOR ALDEHYDES AND KETONES

| <u>Vehicle</u> | <u>Test Cycle</u> | <u>Emission Rates (mg/km)</u> |               |
|----------------|-------------------|-------------------------------|---------------|
|                |                   | <u>Avg. Fuel 1&amp;2</u>      | <u>Fuel 3</u> |
| Formaldehyde   |                   |                               |               |
| Pinto          | FTP               | 0.62                          | 1.74          |
| Sunbrid        | FTP               | 0.68                          | 0.67          |
| Saab           | FTP               | 0.18                          | 0.19          |
| Marquis        | FTP               | 2.81                          | 4.70          |
| Acetaldehyde   |                   |                               |               |
| Pinto          | FTP               | 0.17                          | 0.23          |
| Sunbird        | FTP               | 0.37                          | 0.25          |
| Saab           | FTP               | 0.30                          | 0.61          |
| Marquis        | FTP               | 0.37                          | 0.52          |



TABLE 20. MILEAGE COMPARISONS FOR ALDEHYDES AND KETONES

|               |            | Emission Rates (mg/vm) |                                |                                 |                                |
|---------------|------------|------------------------|--------------------------------|---------------------------------|--------------------------------|
| Vehicle       | Test Cycle |                        |                                |                                 |                                |
|               |            | Initial                | After First<br>5000 mile Accum | After Second<br>5000 mile Accum | After Third<br>5000 mile Accum |
| Formaldehyde  |            |                        |                                |                                 |                                |
| Pinto         | FTP        | 0.14                   | 1.28                           | 1.20                            | 1.33                           |
| Sunbird       | FTP        | 0.22                   | 0.88                           | 0.55                            | 1.05                           |
| Saab          | FTP        | 0.10                   | 0.36                           | 0.04                            | 0.24                           |
| Marquis       | FTP        | 3.65                   | 3.23                           | 2.82                            | 4.05                           |
| Acetaldehyde  |            |                        |                                |                                 |                                |
| Pinto         | FTP        | 0.09                   | 0.14                           | 0.15                            | 0.36                           |
| Sunbird       | FTP        | ND                     | 0.25                           | 0.58                            | 0.33                           |
| Saab          | FTP        | 0.55                   | 0.14                           | 0.27                            | 0.64                           |
| Marquis       | FTP        | 0.30                   | 0.08                           | 0.33                            | 0.88                           |
| Hexanaldehyde |            |                        |                                |                                 |                                |
| Pinto         | FTP        | ND                     | ND                             | ND                              | 0.48                           |
| Sunbird       | FTP        | ND                     | ND                             | 0.15                            | 0.31                           |
| Saab          | FTP        | 0.04                   | 0.01                           | 0.08                            | 0.54                           |
| Marquis       | FTP        | ND                     | ND                             | ND                              | 0.28                           |

TABLE 21. FTP TEST CYCLE EVALUATION FOR ALDEHYDES AND KETONES

| <u>Vehicle</u> | <u>Emission Rates (mg/km)</u> |                       |
|----------------|-------------------------------|-----------------------|
|                | <u>Cold Start UDDS</u>        | <u>Hot Start UDDS</u> |
| Formaldehyde   |                               |                       |
| Pinto          | 1.25                          | 0.88                  |
| Sunbird        | 1.26                          | 0.23                  |
| Saab           | 0.31                          | 0.10                  |
| Marquis        | 3.90                          | 3.43                  |
| Acetaldehyde   |                               |                       |
| Pinto          | 0.22                          | 0.16                  |
| Sunbird        | 0.36                          | 0.23                  |
| Saab           | 0.53                          | 0.30                  |
| Marquis        | 0.57                          | 0.28                  |

A TLV of 2 ppm (2.5 mg/m<sup>3</sup>) has been set by OSHA for formaldehyde concentrations in work areas. The average raw exhaust concentration for the Marquis SET (2.88 mg/m<sup>3</sup>, 1.2 times the TLV) and HFET (3.63 mg/m<sup>3</sup>, 1.5 times the TLV) test cycle exceed this value, while the Marquis FTP and NYCC test cycles do not exceed the TLV (2.25 mg/m<sup>3</sup> FTP, 1.20 mg/m<sup>3</sup> NYCC). The Pinto, Sunbird and Saab have average raw exhaust concentrations that range from 0.04 times the TLV (Saab HFET test cycle, 0.01 mg/m<sup>3</sup>) to 0.6 times the TLV (Pinto SET test cycle, 1.52 mg/m<sup>3</sup>). While the Marquis formaldehyde concentrations exceed the TLV, they are not as large as formaldehyde concentrations from non-catalyst vehicles (7-11 mg/m<sup>3</sup>, 3-4 TLV) and are comparable to formaldehyde concentrations from vehicles with oxidation catalysts (0.3-2.0 mg/m<sup>3</sup>, 0.1-0.87 TLV).<sup>(13)</sup> The TLV concentration for acetaldehyde has been set at 100 ppm (183 mg/m<sup>3</sup>). The largest average acetaldehyde raw exhaust concentration measured in this project is 1.06 mg/m<sup>3</sup> for the Sunbird NYCC test cycle. This emission rate is over two orders of magnitude smaller than the TLV for acetaldehyde.

Organic Amines - The organic amines, which are possible reduced nitrogen exhaust products, have an offensive fish type odor at low concentrations. Inhalation of concentrations higher than 10 ppm will produce moderate to severe irritation of the lungs. The amines are also possible intermediates in the formation of nitrosamines, known carcinogens. The emission rates of six organic amines were measured in this project. These amines, included monomethylamine, dimethylamine, trimethylamine, monoethylamine, diethylamine, and triethylamine. Monoethylamine and dimethylamine could not be analyzed separately and their emission rates are reported as a sum of the two individual emission rates. The vehicle and test cycle emission rates along with the appropriate MDV are presented in Table 22. Diethyl- and triethylamine were not detected in any of the 384 samples analyzed in this project. The compounds, if present in exhaust, are well below the minimum detection value (MDV) listed in Table 22. Trimethylamine was detected in only 7 percent of the samples, with none of the values equal to or exceeding the MDV listed in Table 22. Monomethylamine was detected in 31 percent of the samples, however, less than 2 percent of these samples contained amounts greater than the MDV. Monoethyl- and dimethylamine were detected in 57 percent of the samples, with only 10 percent of these samples containing amounts greater than the MDV. OSHA and the ACGIH have established TLV limits for the organic amines at 10 ppm. The largest average emission rate reported in Table 22 is 0.15 mg/km for the Sunbird NYCC test cycle. This emission rate corresponds to an undiluted exhaust concentration of 0.08 mg/m<sup>3</sup>. This concentration is over two orders of magnitude lower than the TLV of 19 mg/m<sup>3</sup> (10 ppm) established for monoethyl- or dimethylamine. There is a significant loss of monomethylamine (90%) and dimethylamine (50%) to the dilution tunnel at the amine concentrations measured in this project. However, the amine concentrations in exhaust remain over two orders of magnitude lower than the TLV even when the losses are taken into account.

TABLE 22. VEHICLE AND TEST CYCLE COMPARISONS  
FOR ORGANIC AMINES

| Vehicle                        | Emission Rates (mg/km) |       |       |       |
|--------------------------------|------------------------|-------|-------|-------|
|                                | FTP                    | SET   | HFET  | NYCC  |
| Monomethylamine                |                        |       |       |       |
| Pinto                          | 0.01                   | 0.01  | 0.01  | 0.02  |
| Sunbird                        | 0.01                   | 0.01  | 0.01  | 0.04  |
| Saab                           | 0.02                   | 0.01  | 0.01  | 0.02  |
| Marquis                        | 0.01                   | <0.01 | <0.01 | 0.03  |
| MDV (mg/km)                    | 0.04                   | 0.02  | 0.03  | 0.25  |
| Monoethylamine + Dimethylamine |                        |       |       |       |
| Pinto                          | 0.01                   | 0.01  | 0.02  | 0.08  |
| Sunbird                        | 0.02                   | 0.02  | 0.03  | 0.15  |
| Saab                           | 0.02                   | 0.02  | 0.02  | 0.08  |
| Marquis                        | 0.02                   | 0.01  | 0.01  | 0.10  |
| MDV (mg/km)                    | 0.06                   | 0.03  | 0.04  | 0.39  |
| Trimethylamine                 |                        |       |       |       |
| Pinto                          | <0.01                  | <0.01 | <0.01 | <0.01 |
| Sunbird                        | <0.01                  | <0.01 | ND    | 0.01  |
| Saab                           | <0.01                  | <0.01 | <0.01 | <0.01 |
| Marquis                        | <0.01                  | ND    | <0.01 | <0.01 |
| MDV (mg/km)                    | 0.08                   | 0.04  | 0.06  | 0.51  |
| Diethylamine                   |                        |       |       |       |
| - Not Detected -               |                        |       |       |       |
| MDV (mg/km)                    | 0.10                   | 0.06  | 0.07  | 0.63  |
| Triethylamine                  |                        |       |       |       |
| - Not Detected -               |                        |       |       |       |
| MDV (mg/km)                    | 0.14                   | 0.08  | 0.10  | 0.88  |

No fuel or mileage comparisons were made for the organic amines due to the random and small emission rates measured throughout the project. The Pinto, Sunbird, and Marquis gave equivalent or slightly higher emission rates for the cold start UDDS than for the hot start UDDS (Table 23). The Saab gave higher emission rates for the hot start UDDS. There was only one instance where the average cold and hot start emission rates differed by more than 0.01 mg/km. The Sunbird monoethylamine + dimethylamine emission rate was 0.02 mg/km higher for the cold start.

Hydrogen Sulfide - Hydrogen sulfide is a toxic gas for which OSHA and the ACGIH have established TLV concentrations of 20 (28 mg/m<sup>3</sup>) and 10 ppm (14 mg/m<sup>3</sup>) respectively. Hydrogen sulfide has the characteristic odor of rotten eggs and has one of the lowest odor thresholds known, with values ranging from 0.5 (0.71 µg/m<sup>3</sup>) to 5 ppb (7.1 µg/m<sup>3</sup>) (14).

The average emission rates of hydrogen sulfide from the four test vehicles are shown in Table 24. No hydrogen sulfide was detected when testing the Pinto and in only 4 percent of samples when testing the Sunbird (all samples were below the MDV values listed in Table 24). Hydrogen sulfide was detected in 3 percent of the FTP, SET and NYCC samples when testing the Marquis. As was the case with the Sunbird all of these values were below the MDV. Eighteen percent of the Marquis HFET samples gave measurable amounts of hydrogen sulfide with 50 percent of these samples exceeding the MDV. The largest and most frequent amounts of hydrogen sulfide were found when testing the Saab. Twenty-three percent of all samples contained measurable amounts of hydrogen sulfide with 55 percent of these samples containing amounts greater than the MDV. The fuel comparison and the mileage comparison sections of Table 24 show that higher Saab hydrogen sulfide emission rates were obtained when using fuels 2 or 3 at the initial test point. The Saab hydrogen sulfide emission rates dropped from measurable amounts at the initial test point to trace amounts at the first mileage accumulation test point to not detectable at later test points. The hot start UDDS segment of the FTP test cycle gave a higher hydrogen sulfide emission rate for the Saab than the cold start UDDS (0.06 mg/km hot start, 0.04 mg/km cold start). The highest average emission rate listed in Table 24 is 0.31 mg/km for the Saab HFET test cycle at the initial test point. This emission rate corresponds to an undiluted exhaust concentration of 0.38 mg/m<sup>3</sup>, which is over an order of magnitude lower than the TLV established by the ACGIH. The MDV listed in Table 25 however corresponds to undiluted exhaust concentrations that are higher than the odor threshold for hydrogen sulfide. It is possible, therefore, that the characteristic hydrogen sulfide odor of rotten eggs may be detected at low exhaust dilution from vehicles for which no measurable amount of hydrogen sulfide was recorded.

Organic Sulfides - The emission rates of four organic sulfides were measured in this project: carbonyl sulfide, methyl sulfide, ethyl sulfide, and dimethyl disulfide. In general, the organic sulfides are malodorous compounds that produce an unpleasant odor similar to rotten eggs. The average emission rate for each of these sulfides according to vehicle and test cycle are listed in Table 25. A MDV is also listed for each sulfide and test cycle.

TABLE 23. FTP TEST CYCLE EVALUATION FOR ORGANIC AMINES

| <u>Vehicle</u>                 | <u>Emission Rates (mg/km)</u> |                       |
|--------------------------------|-------------------------------|-----------------------|
|                                | <u>Cold Start UDDS</u>        | <u>Hot Start UDDS</u> |
| Monomethylamine                |                               |                       |
| Pinto                          | 0.01                          | 0.01                  |
| Sunbird                        | 0.02                          | 0.01                  |
| Saab                           | 0.01                          | 0.02                  |
| Marquis                        | 0.01                          | <0.01                 |
| Monoethylamine + Dimethylamine |                               |                       |
| Pinto                          | 0.02                          | 0.01                  |
| Sunbird                        | 0.03                          | 0.01                  |
| Saab                           | 0.01                          | 0.02                  |
| Marquis                        | 0.02                          | 0.01                  |
| Trimethylamine                 |                               |                       |
| Pinto                          | <0.01                         | <0.01                 |
| Sunbird                        | <0.01                         | <0.01                 |
| Saab                           | <0.01                         | 0.01                  |
| Marquis                        | <0.01                         | <0.01                 |
| Diethylamine                   |                               |                       |
| - Not Detected -               |                               |                       |
| Triethylamine                  |                               |                       |
| - Not Detected -               |                               |                       |



TABLE 24. AVERAGE HYDROGEN SULFIDE EMISSION RATES

Vehicle and Test Cycle Comparisons

| Vehicle     | Emission Rates (mg/km) |       |      |      |
|-------------|------------------------|-------|------|------|
|             | FTP                    | SET   | HFET | NYCC |
| Pinto       | ND                     | ND    | ND   | ND   |
| Sunbird     | <0.01                  | <0.01 | ND   | ND   |
| Saab        | 0.04                   | 0.07  | 0.08 | 0.02 |
| Marquis     | <0.01                  | <0.01 | 0.03 | ND   |
| MDV (mg/km) | 0.18                   | 0.10  | 0.13 | 1.14 |

Fuel Comparisons

| Vehicle | Test Cycle | Emission Rates (mg/km) |           |
|---------|------------|------------------------|-----------|
|         |            | Fuel 1                 | Fuels 2&3 |
| Saab    | FTP        | 0.02                   | 0.06      |
| Saab    | SET        | 0.04                   | 0.08      |
| Saab    | HFET       | 0.07                   | 0.09      |
| Saab    | NYCC       | ND                     | 0.07      |
| Marquis | HFET       | ND                     | 0.04      |

MILEAGE COMPARISONS

| Vehicle | Test Cycle | Emission Rates (mg/km) |                       |                        |                       |
|---------|------------|------------------------|-----------------------|------------------------|-----------------------|
|         |            | Initial                | First 5000 Mile Accum | Second 5000 Mile Accum | Third 5000 Mile Accum |
| Saab    | FTP        | 0.15                   | 0.02                  | ND                     | ND                    |
| Saab    | SET        | 0.25                   | 0.01                  | ND                     | ND                    |
| Saab    | HFET       | 0.31                   | 0.01                  | ND                     | ND                    |
| Saab    | NYCC       | 0.19                   | ND                    | ND                     | ND                    |

TABLE 25. VEHICLE AND TEST CYCLE COMPARISONS  
FOR ORGANIC SULFIDES

| Vehicle            | Emission Rates (mg/km) |       |       |      |
|--------------------|------------------------|-------|-------|------|
|                    | FTP                    | SET   | HFET  | NYCC |
| Carbonyl Sulfide   |                        |       |       |      |
| Pinto              | 0.07                   | 0.08  | 0.04  | 0.38 |
| Sunbird            | 0.10                   | 0.07  | 0.03  | 0.85 |
| Saab               | 0.03                   | 0.02  | 0.02  | 0.16 |
| Marquis            | 0.24                   | 0.07  | 0.07  | 1.62 |
| MDV (mg/km)        | 0.01                   | 0.01  | 0.01  | 0.05 |
| Methyl Sulfide     |                        |       |       |      |
| Pinto              | 0.02                   | 0.04  | 0.02  | 0.11 |
| Sunbird            | 0.02                   | 0.03  | 0.01  | 0.19 |
| Saab               | 0.02                   | 0.03  | 0.01  | 0.10 |
| Marquis            | 0.03                   | 0.04  | 0.02  | 0.16 |
| MDV (mg/km)        | 0.01                   | 0.01  | 0.01  | 0.05 |
| Ethyl Sulfide      |                        |       |       |      |
| Pinto              | 0.02                   | <0.01 | ND    | 0.03 |
| Sunbird            | 0.03                   | <0.01 | 0.01  | 0.07 |
| Saab               | 0.12                   | 0.01  | 0.01  | 0.02 |
| Marquis            | 0.03                   | <0.01 | <0.01 | 0.12 |
| MDV (mg/km)        | 0.01                   | 0.01  | 0.01  | 0.08 |
| Dimethyl Disulfide |                        |       |       |      |
| Pinto              | 0.01                   | <0.01 | <0.01 | 0.02 |
| Sunbird            | 0.01                   | <0.01 | <0.01 | 0.03 |
| Saab               | 0.04                   | <0.01 | 0.01  | 0.10 |
| Marquis            | 0.01                   | <0.01 | <0.01 | 0.07 |
| MDV (mg/km)        | 0.01                   | 0.01  | 0.01  | 0.08 |

In general, the NYCC test cycle gave the highest organic sulfide emission rates, followed by the FTP  $\approx$  SET and HFET test cycles. The Marquis gave the highest FTP, HFET, and NYCC carbonyl sulfide emission rates, while the Saab gave the highest FTP ethyl sulfide and dimethyl disulfide emission rates. All other vehicles and organic sulfides gave similar emission rates. Carbonyl sulfide and methyl sulfide were detected in 57 and 53 percent of all the samples analyzed. Ethyl sulfide and dimethyl disulfide were detected in only 23 percent of the samples analyzed. Fuels 2 and 3, which contained 10 times the concentration of sulfur in fuel 1, did not give emission rates that differed consistently from fuel 1. The only emission rate trend that was observed with increasing mileage was the decrease in the emission rates of ethyl sulfide and dimethyl disulfide for the Saab FTP test cycle. The average emission rates for each of the sulfides according to cold or hot start operations are listed in Table 26. The cold start UDDS gave higher emission rates for carbonyl sulfide, ethyl sulfide and dimethyl disulfide while the hot start in general gave higher methyl sulfide emission rates.

OSHA and the ACGIH have not established TLV concentrations for the organic sulfides, nor is the odor threshold recorded for the organic sulfides. The largest average emission rate for the organic sulfides is a 1.52 mg/km carbonyl sulfide emission rate from the Marquis NYCC test cycle. This emission rate corresponds to an undiluted carbonyl sulfide exhaust concentration of 0.53 mg/m<sup>3</sup>. If a TLV is assumed to be similar to the hydrogen sulfide TLV of 10 ppm (25 mg/m<sup>3</sup> carbonyl sulfide), the highest undiluted exhaust concentration is found to be 0.02 times the TLV. However, if the odor threshold for the organic sulfides is similar to hydrogen sulfide, the rotten egg odor attributed to the organic sulfides could be detected in undiluted exhaust at levels one order of magnitude lower than concentrations corresponding to the MDV.

As was the case with the organic amines, there is a significant loss of ethyl sulfide, methyl sulfide, and dimethyl disulfide in the dilution tunnel.<sup>(1)</sup> If these losses are taken into account, the emission rates for methyl sulfide, ethyl sulfide, and dimethyl disulfide would be on the order of 5 to 25 times higher than the emission rates recorded in Table 25. Raw exhaust concentrations, however, would remain 1 to 2 orders of magnitude lower than the projected TLV values.

**Sulfur Dioxide** - Sulfur dioxide is a highly irritating gas and is almost irrespirable. Its odor is readily detectable in concentrations of 3-5 ppm. Sulfur dioxide in exhaust is produced by the combustion of sulfur in fuel. The emission rates for sulfur dioxide were recorded in this project only at the second and third mileage accumulation test points for the Sunbird and Saab and only at the third mileage accumulation test point for the Pinto and Marquis. Table 27 gives the average sulfur dioxide emission rates for fuels 2 and 3. The Pinto and Marquis (both have 3-way catalysts followed by oxidation catalysts) have similar emission rates with the highest rates from the NYCC test cycles and the lowest rates from the HFET test cycles. The Sunbird and Saab (3-way catalysts only) have the highest emission rates from the HFET test cycle. The second part of Table 27 shows

TABLE 26. FTP TEST CYCLE EVALUATION FOR ORGANIC SULFIDES

| <u>Vehicle</u>     | <u>Emissions Rates (mg/km)</u> |                       |
|--------------------|--------------------------------|-----------------------|
|                    | <u>Cold Start UDDS</u>         | <u>Hot Start UDDS</u> |
| Carbonyl Sulfide   |                                |                       |
| Pinto              | 0.09                           | 0.07                  |
| Sunbird            | 0.14                           | 0.07                  |
| Saab               | 0.04                           | 0.02                  |
| Marquis            | 0.25                           | 0.23                  |
| Methyl Sulfide     |                                |                       |
| Pinto              | 0.02                           | 0.01                  |
| Sunbird            | 0.01                           | 0.02                  |
| Saab               | 0.01                           | 0.03                  |
| Marquis            | 0.02                           | 0.04                  |
| Ethyl Sulfide      |                                |                       |
| Pinto              | 0.04                           | ND                    |
| Sunbird            | 0.04                           | <0.01                 |
| Saab               | 0.21                           | 0.03                  |
| Marquis            | 0.05                           | 0.01                  |
| Dimethyl Disulfide |                                |                       |
| Pinto              | 0.01                           | <0.01                 |
| Sunbird            | 0.01                           | 0.01                  |
| Saab               | 0.10                           | <0.01                 |
| Marquis            | 0.01                           | 0.01                  |

TABLE 27. AVERAGE SULFUR DIOXIDE EMISSION RATES

Vehicle and Test Cycle Comparison  
(Average for Fuels 2 and 3 Only)

| Vehicle     | Emission Rates (mg/km) |       |       |       |
|-------------|------------------------|-------|-------|-------|
|             | FTP                    | SET   | HFET  | NYCC  |
| Pinto       | 26.33                  | 29.84 | 15.68 | 50.07 |
| Sunbird     | 15.43                  | 34.53 | 44.67 | 40.40 |
| Saab        | 30.08                  | 26.68 | 37.47 | 36.37 |
| Marquis     | 24.90                  | 37.23 | 18.43 | 57.53 |
| MDV (mg/km) | 0.05                   | 0.02  | 0.03  | 0.28  |

Fuel Comparisons

| Vehicle | Test Cycle | Emission Rates |                |
|---------|------------|----------------|----------------|
|         |            | Fuel 1         | Avg. Fuels 2&3 |
| Pinto   | SET        | 16.59          | 29.84          |
| Pinto   | HFET       | 4.08           | 15.68          |
| Sunbird | SET        | 14.83          | 34.53          |
| Sunbird | HFET       | 18.04          | 43.67          |
| Saab    | SET        | 10.05          | 26.68          |
| Saab    | HFET       | 10.35          | 37.47          |
| Marquis | SET        | 7.36           | 37.23          |
| Marquis | HFET       | 5.87           | 18.43          |

FTP Test Cycle Evaluation

| Vehicle | Emission Rates (mg/km) |                |
|---------|------------------------|----------------|
|         | Cold Start UDDS        | Hot Start UDDS |
| Pinto   | 29.29                  | 24.09          |
| Sunbird | 13.06                  | 17.20          |
| Saab    | 35.40                  | 26.06          |
| Marquis | 21.90                  | 27.16          |

a comparison of the SET and HFET average emission rates from fuel 1 with the average emission rates from fuels 2 and 3. The magnitude of the difference in the emission rates does not approach the 10 fold difference in fuel sulfur, but in general the higher sulfur content fuels (2 and 3) have emission rates 2 to 5 times the rate for fuel 1. The third part of Table 27 shows a comparison of the cold and hot start segments of the FTP test cycle. There appears to be no general trend for the cold or hot start operation with two vehicles having higher emission rates for the cold start (Pinto, Saab) and two having higher emission rates for the hot start (Sunbird, Marquis).

Sulfur dioxide is a toxic gas with TLV limits of 5 ppm (13 mg/m<sup>3</sup>) set by both OSHA and the ACGIH. All the FTP, SET, HFET and NYCC emission rates (fuels 2 and 3) for all four vehicles correspond to undiluted sulfur dioxide exhaust concentrations which exceed the TLV concentration of 13 mg/m<sup>3</sup>. These undiluted concentrations range from 15.36 mg/m<sup>3</sup> (1.2 times the TLV) for the Sunbird FTP test cycle to 61.27 mg/m<sup>3</sup> (4.7 times the TLV) for the Sunbird HFET test cycle. However, the magnitude that sulfur dioxide exceeds its TLV does not approach that found for CO and NO<sub>x</sub>, 77 and 108 respectively.

Sulfate - Sulfate is a toxic substance when in the form of sulfuric acid. Sulfate results from the catalytic oxidation of sulfur dioxide to sulfur trioxide, which in turn is hydrated to form sulfuric acid. The average sulfate emission rates with respect to vehicle and test cycle for this project are shown in Table 28. Only the average emission rates of fuels 2 and 3 are listed in the table. Both fuels have a 0.03 weight percent concentration of sulfur. The Saab and Sunbird have emission rates near or below the MDV for all four test cycles. The Pinto and Marquis have emission rates over two orders of magnitude higher for the SET and HFET test cycles than the Sunbird and Saab. The Pinto and Marquis FTP sulfate emission rates are also over an order of magnitude higher than the the Sunbird and Saab FTP emission rates. The NYCC sulfate emission rates for all four vehicles are near or below the MDV; however, the general trend is also for higher sulfate emission rates from the Pinto and Marquis. The trend for higher sulfate emissions from catalysts with auxiliary air injection parallels the trend found for oxidation catalysts. (15,16) Non-catalyst vehicles and vehicles equipped with oxidation catalysts without air injection give emission rates similar to those found in this study for the Sunbird and Saab. Vehicles equipped with oxidation catalysts having auxiliary air injection into the catalysts give emission rates similar to those found for the Pinto and Marquis. The SET and HFET sulfate emission rates according to sulfur concentration are shown in the second part of Table 28. No significant difference can be seen in the Sunbird and Saab emission rates for the low (0.003 weight percent) sulfur content fuel 1 and fuels 2 and 3, which have a 0.03 weight percent sulfur content. The Pinto and Marquis, however, have emission rates that are much larger for fuels 2 and 3 (4-6 times larger from the Pinto, 50-120 times larger from the Marquis) than for fuel 1. No definite trends in emission rates were found with increasing mileage accumulation.

The emission rates according to cold or hot start operation are shown in the FTP test cycle evaluation section of Table 28. The Pinto and Marquis



TABLE 28. AVERAGE SULFATE EMISSION RATES

Vehicle and Test Cycle Comparison  
(Average for Fuels 2 and 3 Only)

| Vehicle     | Emission Rates (mg/km) |       |       |      |
|-------------|------------------------|-------|-------|------|
|             | FTP                    | SET   | HFET  | NYCC |
| Pinto       | 1.44                   | 20.50 | 26.44 | 0.84 |
| Sunbird     | 0.07                   | 0.05  | 0.07  | 0.10 |
| Saab        | 0.15                   | 0.07  | 0.04  | 0.32 |
| Marquis     | 1.15                   | 14.36 | 21.55 | 0.64 |
| MDV (mg/km) | 0.10                   | 0.05  | 0.07  | 0.63 |

## Fuel Comparisons

| Vehicle | Test Cycle | Emission Rates (mg/km) |               |
|---------|------------|------------------------|---------------|
|         |            | Fuel 1                 | Avg. Fuel 2&3 |
| Pinto   | SET        | 3.42                   | 20.50         |
| Pinto   | HFET       | 6.31                   | 26.44         |
| Sunbird | SET        | 0.04                   | 0.06          |
| Sunbird | HFET       | 0.02                   | 0.07          |
| Saab    | SET        | 0.07                   | 0.06          |
| Saab    | HFET       | 0.02                   | 0.04          |
| Marquis | SET        | 0.12                   | 14.36         |
| Marquis | HFET       | 0.42                   | 21.55         |

## FTP Test Cycle Evaluation

| Vehicle | Emission Rates (mg/km) |                |
|---------|------------------------|----------------|
|         | Cold Start UDDS        | Hot Start UDDS |
| Pinto   | 0.70                   | 1.78           |
| Sunbird | 0.12                   | 0.03           |
| Saab    | 0.27                   | 0.04           |
| Marquis | 0.67                   | 1.50           |

have higher hot start emission rates (2.2 and 2.5 times higher than the cold start), while the Sunbird and Saab have higher cold start emission rates (4 and 7 times higher than the hot start).

The ACGIH has established a TLV of  $1 \text{ mg/m}^3$  for sulfuric acid. If the sulfate emitted from the test vehicles is in the form of sulfuric acid then the Pinto and Marquis have undiluted SET and HFET sulfate exhaust concentrations that exceed the TLV. The Pinto and Marquis SET and HFET average emission rates for fuels 2 and 3 correspond to undiluted exhaust concentrations of  $24.6 \text{ mg/m}^3$  (24.6 times the TLV - Pinto SET test cycle),  $32.0 \text{ mg/m}^3$  (32 times the TLV - Pinto HFET test cycle),  $12.5 \text{ mg/m}^3$  (12.5 times the TLV - Marquis SET test cycle) and  $22.8 \text{ mg/m}^3$  (22.8 times the TLV - Marquis HFET test cycle). The only other sulfate emission rate that exceeds the TLV is the Pinto FTP emission rate which gives an undiluted sulfate concentration of  $1.3 \text{ mg/m}^3$  (1.3 times TLV). If the Pinto HFET sulfate emission rate  $32.0 \text{ mg/km}$  is inserted into the model situation described for CO and  $\text{NO}_x$ , a commuter exposure concentration of  $19.7 \text{ } \mu\text{g/m}^3$  (0.02 times the TLV) is obtained.

**Total Cyanide** - Total cyanide includes hydrogen cyanide and cyanogen, which are both flammable, toxic gases (hydrogen cyanide has a boiling point of  $25.7^\circ\text{C}$ ) with the characteristic odor of bitter almonds. The cyanides are formed by the reduction of nitrogen or nitrogen oxides. The average total cyanide emission rates with respect to vehicle and test cycles for this project are given in Table 29. The table shows that the Sunbird and Saab (3-way catalysts only) give higher emissions (5-27 fold higher for the SET and HFET test cycles, and 1.5 to 5 fold higher for the FTP and NYCC test cycles) than the Pinto and Marquis (3-way + oxidation catalysts). The NYCC test cycle gave the highest cyanide rates, followed by the FTP, the SET, and HFET test cycles in that order. No difference in cyanide emission rate with respect to fuel was found. The cyanide emission rate was found to increase with increasing mileage (Table 29) for the Pinto and Sunbird in all four test cycles. The Saab and Marquis FTP cyanide emission rates show a decrease in magnitude from the initial test point to the first mileage accumulation test point, followed by a gradual increase for the remaining mileage test points. This trend was found to be the case in all four test cycles for the Saab, but the other three test cycles for the Marquis showed a gradual increase from the initial to the final mileage test point. The average cyanide emission rates for the cold start UDDS segment of the FTP test cycles are 1.5 to 2.9 times higher than the cyanide emission rates from the hot start UDDS (Table 29).

OSHA and the ACGIH have established a TLV of 10 ppm ( $11 \text{ mg/m}^3$ ) for hydrogen cyanide, and the ACGIH alone has established a TLV of 10 ppm ( $20 \text{ mg/m}^3$ ) for cyanogen. The Sunbird SET test cycle gives the highest cyanide concentration in undiluted exhaust. This concentration,  $4.83 \text{ mg/m}^3$ , is less than half the TLV,  $11 \text{ mg/m}^3$ , established for hydrogen cyanide.

**Ammonia** - Ammonia is a toxic gas which is formed in exhaust by the reduction of nitrogen. The average vehicle and test cycle emission rates for ammonia are listed in Table 30. With the exception of the Saab, the

TABLE 29. AVERAGE TOTAL CYANIDE EMISSION RATES

Vehicle and Test Cycle Comparisons

| Vehicle     | Emission Rates (mg/km) |      |      |      |
|-------------|------------------------|------|------|------|
|             | FTP                    | SET  | HFET | NYCC |
| Pinto       | 0.76                   | 0.20 | 0.17 | 2.57 |
| Sunbird     | 3.57                   | 4.01 | 3.00 | 5.42 |
| Saab        | 1.86                   | 1.01 | 1.19 | 3.73 |
| Marquis     | 0.99                   | 0.15 | 0.23 | 2.46 |
| MDV (mg/km) | 0.05                   | 0.03 | 0.04 | 0.31 |

Mileage Comparisons

| Vehicle | Test Cycle | Emission Rates (mg/km) |                             |                              |                             |
|---------|------------|------------------------|-----------------------------|------------------------------|-----------------------------|
|         |            | Initial                | After First 5000 mile Accum | After Second 5000 mile Accum | After Third 5000 mile Accum |
| Pinto   | FTP        | 0.16                   | 0.56                        | 1.08                         | 1.26                        |
| Sunbird | FTP        | 2.42                   | 2.66                        | 4.15                         | 5.05                        |
| Saab    | FTP        | 2.13                   | 1.26                        | 1.64                         | 2.41                        |
| Marquis | FTP        | 2.17                   | 0.35                        | 0.48                         | 0.94                        |

FTP Test Cycle Evaluation

| Vehicle | Emission Rates (mg/km) |                |
|---------|------------------------|----------------|
|         | Cold Start UDDS        | Hot Start UDDS |
| Pinto   | 1.25                   | 0.43           |
| Sunbird | 4.52                   | 2.82           |
| Saab    | 2.29                   | 1.53           |
| Marquis | 1.38                   | 0.68           |

TABLE 30. AVERAGE AMMONIA EMISSION RATES

## Vehicle and Test Cycle Comparisons

| Vehicle     | Emission Rates (mg/km). |       |       |       |
|-------------|-------------------------|-------|-------|-------|
|             | FTP                     | SET   | HFET  | NYCC  |
| Pinto       | 2.85                    | 1.34  | 2.23  | 19.56 |
| Sunbird     | 3.43                    | 3.35  | 3.29  | 26.16 |
| Saab        | 21.68                   | 20.47 | 22.41 | 82.36 |
| Marquis     | 2.34                    | 1.24  | 1.67  | 12.62 |
| MDV (mg/km) | 0.05                    | 0.03  | 0.03  | 0.31  |

## Mileage Comparisons

| Vehicle | Test Cycle | Emission Rates (mg/km) |                                |                                 |                                |
|---------|------------|------------------------|--------------------------------|---------------------------------|--------------------------------|
|         |            | Initial                | After First<br>5000 mile Accum | After Second<br>5000 mile Accum | After Third<br>5000 mile Accum |
| Saab    | FTP        | 75.22                  | 3.27                           | 6.42                            | 1.80                           |
| Saab    | SET        | 75.04                  | 1.43                           | 4.09                            | 1.31                           |
| Saab    | HFET       | 83.77                  | 1.43                           | 2.96                            | 1.45                           |
| Saab    | NYCC       | 281.30                 | 15.52                          | 21.38                           | 11.21                          |

## FTP Test Cycle Evaluation

| Vehicle | Emission Rates (mg/km) |                |
|---------|------------------------|----------------|
|         | Cold Start UDDS        | Hot Start UDDS |
| Pinto   | 2.40                   | 2.48           |
| Sunbird | 3.78                   | 3.28           |
| Saab    | 19.03                  | 23.67          |
| Marquis | 2.67                   | 2.09           |

vehicles all give similar ammonia emission rates. The overall higher emission rates for the Saab are solely due to the emission rates at the initial test point (Table 30). The emission rates at the initial test point were 25 times as high as the emission rates at the other three mileage test points. If the initial test point is disregarded, then the emission rates for the Saab would be comparable to the emission rates for the other three vehicles. The NYCC test cycle gives the highest emission rate for all four vehicles. The FTP, SET, and HFET emission rates are similar for the Sunbird and for the Saab. The SET test cycle gives the lowest ammonia emission rate for the Pinto and Marquis followed by the HFET and FTP test cycles, respectively. Only small differences in the ammonia emission rates for the cold and hot UDDS segments of the FTP test cycle were found for all four vehicles (Table 30).

OSHA and the ACGIH have established TLV of 50 ppm ( $35 \text{ mg/m}^3$ ) and 25 ppm ( $18 \text{ mg/m}^3$ ), respectively for ammonia. Only the undiluted ammonia exhaust concentrations for the Saab at the initial test point exceed either of these TLV. The highest undiluted ammonia exhaust concentration was measured for the Saab NYCC test cycle at the initial test point. This value,  $154 \text{ mg/m}^3$ , is 4.4 times the OSHA TLV and 8.8 times the ACGIH TLV. The average undiluted ammonia exhaust concentrations for the other Saab test cycles exceed the OSHA TLV by a factor of 2 to 3 and the ACGIH TLV by a factor of 4 to 6. None of the other three vehicles gave diluted ammonia exhaust concentrations that exceed either of the TLV.

There is a significant loss of ammonia in the dilution tunnel that is dependent on the concentration of ammonia in the tunnel.<sup>(1)</sup> At concentrations of 5 to 10 ppm ammonia, there is a 50 percent loss of ammonia in the dilution tunnel. At concentrations of 0.5 to 1.0 ppm, there is an approximate 85 percent loss of ammonia in the dilution tunnel. If these losses are taken into account, the Saab NYCC test cycle at the initial test point would exceed the ACGIH TLV by a factor of 18 and the remaining three vehicles would also give ammonia concentrations that equal or slightly exceed the ACGIH TLV.

Nitrous Oxide - Nitrous oxide is a nontoxic gas and is used extensively as an anesthetic in medicine and dentistry. The emission rate of nitrous oxide is of some concern, however, due to nitrous oxide's potential effect on the atmospheric ozone layer. The average nitrous oxide emission rates for the four vehicles and four test cycles are listed in Table 31. The Marquis has the highest emission rates of nitrous oxide for all four test cycles. The Pinto, Saab, and Sunbird each have test cycles with the second highest emission rate. With the exception of the emission rate from the Sunbird FTP test cycle, the NYCC test cycles give the highest nitrous oxide emission rates with the FTP, SET, and HFET giving lesser rates in that order. Fuels 1 and 2 give higher nitrous oxide emission rates than fuel 3 (Table 31). The nitrous oxide emission rates increase with increasing mileage for the Sunbird, Saab, and Marquis, while the Pinto nitrous oxide emission rates show no definite trend. The dilute nitrous oxide exhaust concentrations (ppm) are given in Table 31 for each segment of the four segment FTP test

TABLE 31. AVERAGE NITROUS OXIDE EMISSION RATES

Vehicle and Test Cycle Comparisons

| <u>Vehicle</u> | <u>Emission Rates (mg/km)</u> |            |             |             |
|----------------|-------------------------------|------------|-------------|-------------|
|                | <u>FTP</u>                    | <u>SET</u> | <u>HFET</u> | <u>NYCC</u> |
| Pinto          | 22.27                         | 10.99      | 7.20        | 44.92       |
| Sunbird        | 26.54                         | 7.34       | 4.41        | 23.78       |
| Saab           | 15.57                         | 9.81       | 8.14        | 36.24       |
| Marquis        | 28.00                         | 17.64      | 10.92       | 56.50       |
| MDV (mg/km)    | 0.31                          | 0.16       | 0.12        | 0.84        |

Fuel Comparisons

| <u>Vehicle</u> | <u>Test Cycle</u> | <u>Emission Rates (mg/km)</u> |               |
|----------------|-------------------|-------------------------------|---------------|
|                |                   | <u>Avg. Fuel 1&amp;2</u>      | <u>Fuel 3</u> |
| Pinto          | FTP               | 22.36                         | 22.10         |
| Sunbird        | FTP               | 27.24                         | 25.14         |
| Saab           | FTP               | 16.18                         | 14.36         |
| Marquis        | FTP               | 28.62                         | 26.78         |



TABLE 31 (Cont'd). AVERAGE NITROUS OXIDE EMISSION RATES

FTP Test Cycle Evaluation

| Vehicle | Dilute Exhaust Concentration ppm |               |               |               |
|---------|----------------------------------|---------------|---------------|---------------|
|         | Cold Start                       |               | Hot Start     |               |
|         | Cold Start 505                   | Stabilize 867 | Hot Start 505 | Stabilize 867 |
| Pinto   | 0.77                             | 0.34          | 1.57          | 0.35          |
| Sunbird | 2.42                             | 0.25          | 1.34          | 0.24          |
| Saab    | 0.71                             | 0.14          | 1.13          | 0.20          |
| Marquis | 1.47                             | 0.39          | 1.62          | 0.46          |

Mileage Comparisons

| Vehicle | Test Cycle | Emission Rates (mg/km) |                 |                 |                 |
|---------|------------|------------------------|-----------------|-----------------|-----------------|
|         |            | Initial                | After First     | After Second    | After Third     |
|         |            | Initial                | 5000 mile Accum | 5000 mile Accum | 5000 mile Accum |
| Pinto   | FTP        | 21.13                  | 20.48           | 25.52           | 21.95           |
| Sunbird | FTP        | 19.83                  | 29.35           | 27.32           | 29.67           |
| Saab    | FTP        | 10.27                  | 14.92           | 15.52           | 21.57           |
| Marquis | FTP        | 22.07                  | 23.04           | 29.51           | 37.39           |

cycle. The hot start 505 segment of the FTP had the highest nitrous oxide emission rates followed by the cold start 505, the hot start stabilize 867 and the cold start stabilize 867 segments for the Pinto, Saab and Marquis. The Sunbird nitrous oxide emission rates were highest from the cold start 505 segment, with the hot start 505, cold start stabilize 867, and the hot start stabilize segments giving lower rates.

Nickel Carbonyl - Nickel carbonyl is an extremely toxic gas which can be found in the presence of nickel metal and carbon monoxide. In this study, analyses were conducted for nickel carbonyl on all vehicles, test cycles, fuels and at all mileage test points. Nickel carbonyl was not detected in any of the analyses. The MDV for the FTP, SET, HFET, and NYCC test cycles are 0.01, 0.01, 0.01 and 0.03 mg/km, respectively. Nickel carbonyl is an extremely toxic gas for which OSHA and the ACGIH have set TLV of 0.001 ppm (0.007 mg/m<sup>3</sup>). The MDV correspond to undiluted nickel carbonyl concentrations equivalent to the TLV. If nickel carbonyl is present in exhaust it is present at levels lower than the TLV. These findings are consistent with other studies which have also failed to detect nickel carbonyl in automobile exhaust. (9,10,17,18)

Metals and Other Elements - The emission rates of twenty-seven metals and other elements were determined in this project. These metals and other elements include: chromium, lead, manganese, mercury, bromine, phosphorus, silicon, cadmium, aluminum, sulfur, sodium, magnesium, potassium, chlorine, platinum, zinc, copper, nickel, iron, vanadium, titanium, barium, calcium, tin, antimony, selenium, and cobalt. Only emission rates of 0.01 mg/km or larger were reported for the elements in this project.

Antimony, cadmium, mercury, platinum, selenium, and tin were detected on less than one percent of the 480 filters analyzed. Mercury and platinum were not detected in any of the filters, while antimony, cadmium, selenium, and tin were each detected on only one filter. Cadmium and selenium were detected on filters from the Marquis FTP test cycles (both were found on only the hot start UDDS filter) and gave FTP emission rates of 0.01 and 0.02 mg/km respectively. Antimony was detected on a filter taken during a Saab NYCC test cycle (NYCC emission rate of 0.02 mg/km) and tin was found on a filter taken during a Marquis HFET test cycle (HFET emission rate of 0.01 mg/km).

Chromium, cobalt, copper, manganese, nickel and titanium were detected on five percent or less of the filters analyzed. Table 32 lists the average emission rates for these six elements according to vehicle and test cycle. Only the Saab FTP test cycle gave average emission rates higher than 0.01 mg/km for any of these six elements (chromium 0.03 mg/km). All six of these elements are metals and are used in steel or brass alloys. Cobalt, copper and manganese were found only in the cold state UDDS filter for the FTP test cycle. Chromium, nickel and titanium were each found only on one hot start UDDS filter. No mileage or fuel trends were observed for the emission rates of these elements.

TABLE 32. VEHICLE AND TEST CYCLE COMPARISONS FOR  
CHROMIUM, COBALT, COPPER, MANGANESE, NICKEL AND TITANIUM

| Vehicle   | Emission Rates (mg/km) |       |       |       |
|-----------|------------------------|-------|-------|-------|
|           | FTP                    | SET   | HFET  | NYCC  |
| Chromium  |                        |       |       |       |
| Pinto     | <0.01                  | <0.01 | ND    | ND    |
| Sunbird   | ND                     | ND    | ND    | ND    |
| Saab      | 0.02                   | <0.01 | ND    | ND    |
| Marquis   | 0.01                   | <0.01 | ND    | ND    |
| Cobalt    |                        |       |       |       |
| Pinto     | <0.01                  | ND    | <0.01 | ND    |
| Sunbird   | ND                     | ND    | ND    | 0.01  |
| Saab      | <0.01                  | ND    | ND    | ND    |
| Marquis   | <0.01                  | ND    | ND    | ND    |
| Copper    |                        |       |       |       |
| Pinto     | ND                     | ND    | <0.01 | ND    |
| Sunbird   | <0.01                  | <0.01 | ND    | 0.01  |
| Saab      | 0.01                   | <0.01 | <0.01 | 0.01  |
| Marquis   | ND                     | ND    | ND    | ND    |
| Manganese |                        |       |       |       |
| Pinto     | <0.01                  | ND    | ND    | ND    |
| Sunbird   | <0.01                  | <0.01 | ND    | ND    |
| Saab      | <0.01                  | ND    | ND    | ND    |
| Marquis   | <0.01                  | ND    | ND    | ND    |
| Nickel    |                        |       |       |       |
| Pinto     | ND                     | ND    | ND    | ND    |
| Sunbird   | <0.01                  | ND    | ND    | ND    |
| Saab      | 0.01                   | <0.01 | <0.01 | ND    |
| Marquis   | <0.01                  | ND    | ND    | ND    |
| Titanium  |                        |       |       |       |
| Pinto     | ND                     | <0.01 | ND    | <0.01 |
| Sunbird   | <0.01                  | <0.01 | ND    | <0.01 |
| Saab      | <0.01                  | <0.01 | <0.01 | <0.01 |
| Marquis   | <0.01                  | <0.01 | <0.01 | <0.01 |

Bromine, potassium, sodium, and vanadium were detected on 6 to 15 percent of the filters analyzed. Table 33 lists the average emission rates for these four elements according to vehicle and test cycle. Only the average bromine emission rates exceed 0.01 mg/km. All four elements were found on both hot and cold start UDDS filters in the FTP test cycle. No mileage or fuel trends were observed for the four elements. The frequency that these elements appeared on the filters was much greater for the Sunbird and Saab (45 and 72 occurrences out of a possible 480) than for the Pinto and Marquis (18 and 20 occurrences out of a possible 480). Vanadium is used in steel alloys. The source of bromine, potassium, and sodium is unknown.

Lead, zinc, and silicon were found in one-fourth to one-third of the filters analyzed. Table 34 lists the average emission rates for these three elements according to vehicle and test cycle. The NYCC test cycle gave the highest lead emission rates, while the FTP test cycle gave the highest zinc and silicon emission rates.

The Saab gave the highest lead and silicon emission rates. Of the filters that contained either lead or silicon, forty percent of the filters were from the Saab. The Pinto and Sunbird gave the highest zinc emissions rates. Lead was found most frequently in filters taken after the first and second 5000 mile accumulation test points. Silicon was found most frequently in filters taken at the initial test point and after the third 5000 mile accumulation test point. No mileage trend was found for the zinc emission rates. No fuel trends were observed for the lead, zinc and silicon emission rates. The cold start average emission rates were higher than the average hot start emission rates for lead (cold start, 0.06-0.24 mg/km; hot start, 0.03-0.09 mg/km), zinc (cold start, 0.02-0.04 mg/km; hot start, ND-0.02 mg/km), and silicon (cold start, <0.01-0.03 mg/km; hot start <0.01 mg/km). The appearance of lead in the exhaust could be due to contamination from leaded fuel. The lubricant used in this project was found by X-ray to contain zinc. During the mileage accumulation, the Pinto and Sunbird used more oil than either the Saab or Marquis. The higher zinc emission rates for the Pinto and Sunbird could be explained by this usage.

Aluminum, barium, calcium, magnesium, chlorine, iron, phosphorus, and sulfur were each detected in over one-half of the filters analyzed. Table 35 lists the average emission rates for aluminum, barium, calcium, and magnesium, while Table 36 lists the emission rates for chlorine, iron, phosphorus, and sulfur according to vehicle and test cycle.

The Saab gave the highest average aluminum vehicle emission rates (Table 35), while the Pinto, Saab, and the Marquis gave iron emission rates 2 to 5 times higher than the Sunbird iron emission rates (Table 36). The FTP test cycle gave the highest average aluminum and iron test cycle emission rates (Tables 35 and 36). No fuel or mileage trends were observed for either the aluminum or iron emission rates. The cold start aluminum and iron emission rates were higher than the hot start emission rates for the Pinto, Saab, and Marquis and approximately equal for the Sunbird (Table 37). Aluminum and iron are metals and are used in several metal alloys.

TABLE 33. VEHICLE AND TEST CYCLE COMPARISONS FOR  
BROMINE, POTASSIUM, SODIUM, AND VANADIUM

| Vehicle   | Emission Rates (mg/km) |       |       |       |
|-----------|------------------------|-------|-------|-------|
|           | FTP                    | SET   | HFET  | NYCC  |
| Bromine   |                        |       |       |       |
| Pinto     | ND                     | ND    | ND    | ND    |
| Sunbird   | 0.01                   | 0.01  | 0.02  | 0.02  |
| Saab      | 0.03                   | 0.04  | 0.05  | 0.08  |
| Marquis   | <0.01                  | ND    | ND    | 0.03  |
| Potassium |                        |       |       |       |
| Pinto     | <0.01                  | ND    | ND    | <0.01 |
| Sunbird   | <0.01                  | ND    | ND    | <0.01 |
| Saab      | <0.01                  | ND    | <0.01 | 0.01  |
| Marquis   | <0.01                  | <0.01 | <0.01 | <0.01 |
| Sodium    |                        |       |       |       |
| Pinto     | <0.01                  | <0.01 | <0.01 | ND    |
| Sunbird   | <0.01                  | 0.01  | <0.01 | ND    |
| Saab      | 0.01                   | <0.01 | <0.01 | ND    |
| Marquis   | ND                     | ND    | ND    | ND    |
| Vanadium  |                        |       |       |       |
| Pinto     | <0.01                  | ND    | <0.01 | <0.01 |
| Sunbird   | <0.01                  | <0.01 | <0.01 | 0.01  |
| Saab      | <0.01                  | <0.01 | <0.01 | 0.01  |
| Marquis   | <0.01                  | ND    | <0.01 | 0.01  |

TABLE 34. VEHICLE AND TEST CYCLE COMPARISONS FOR  
LEAD, ZINC, AND SILICON

| Vehicle | Emission Rates (mg/km) |       |       |       |
|---------|------------------------|-------|-------|-------|
|         | FTP                    | SET   | HFET  | NYCC  |
| Lead    |                        |       |       |       |
| Pinto   | 0.05                   | 0.03  | 0.03  | 0.24  |
| Sunbird | 0.07                   | 0.06  | 0.05  | 0.17  |
| Saab    | 0.13                   | 0.09  | 0.11  | 0.66  |
| Marquis | 0.09                   | 0.06  | 0.04  | 0.42  |
| Zinc    |                        |       |       |       |
| Pinto   | 0.03                   | 0.02  | 0.01  | ND    |
| Sunbird | 0.03                   | 0.02  | 0.01  | 0.01  |
| Saab    | 0.02                   | ND    | ND    | 0.01  |
| Marquis | 0.01                   | ND    | ND    | 0.01  |
| Silicon |                        |       |       |       |
| Pinto   | <0.01                  | 0.01  | <0.01 | 0.01  |
| Sunbird | 0.01                   | <0.01 | <0.01 | <0.01 |
| Saab    | 0.02                   | 0.01  | 0.01  | 0.01  |
| Marquis | <0.01                  | <0.01 | <0.01 | 0.01  |



TABLE 35. VEHICLE AND TEST CYCLE COMPARISONS FOR  
ALUMINUM, BARIUM, CALCIUM, AND MAGNESIUM

| Vehicle   | Emission Rates (mg/km) |       |       |       |
|-----------|------------------------|-------|-------|-------|
|           | FTP                    | SET   | HFET  | NYCC  |
| Aluminum  |                        |       |       |       |
| Pinto     | 0.02                   | 0.01  | 0.01  | <0.01 |
| Sunbird   | 0.02                   | 0.02  | 0.01  | 0.01  |
| Saab      | 0.07                   | 0.02  | 0.01  | 0.01  |
| Marquis   | 0.03                   | 0.01  | <0.01 | 0.01  |
| Barium    |                        |       |       |       |
| Pinto     | 0.10                   | 0.06  | 0.05  | 0.16  |
| Sunbird   | 0.07                   | 0.06  | 0.06  | 0.10  |
| Saab      | 0.04                   | 0.02  | 0.01  | 0.01  |
| Marquis   | 0.04                   | 0.01  | 0.01  | ND    |
| Calcium   |                        |       |       |       |
| Pinto     | 0.01                   | 0.01  | 0.01  | 0.02  |
| Sunbird   | 0.02                   | 0.01  | 0.01  | 0.03  |
| Saab      | 0.02                   | 0.01  | 0.01  | 0.02  |
| Marquis   | 0.02                   | 0.01  | 0.01  | 0.03  |
| Magnesium |                        |       |       |       |
| Pinto     | 0.03                   | 0.02  | 0.01  | 0.06  |
| Sunbird   | 0.02                   | 0.03  | 0.03  | 0.04  |
| Saab      | 0.02                   | 0.01  | 0.01  | 0.02  |
| Marquis   | 0.01                   | <0.01 | <0.01 | <0.01 |

TABLE 36. VEHICLE AND TEST CYCLE COMPARISONS FOR  
CHLORINE, IRON, PHOSPHORUS, AND SULFUR

| Vehicle                                    | Emission Rates (mg/km) |       |       |       |
|--------------------------------------------|------------------------|-------|-------|-------|
|                                            | FTP                    | SET   | HFET  | NYCC  |
| Chlorine                                   |                        |       |       |       |
| Pinto                                      | 5.41                   | 0.48  | 0.02  | 0.64  |
| Sunbird                                    | 6.37                   | 19.93 | 15.32 | 3.36  |
| Saab                                       | 24.46                  | 20.35 | 11.76 | 5.78  |
| Marquis                                    | 6.52                   | 2.25  | 0.43  | 1.02  |
| Iron                                       |                        |       |       |       |
| Pinto                                      | 1.24                   | 0.40  | 0.12  | 0.05  |
| Sunbird                                    | 0.32                   | 0.19  | 0.06  | 0.01  |
| Saab                                       | 1.37                   | 0.32  | 0.11  | 0.09  |
| Marquis                                    | 1.32                   | 0.20  | 0.04  | 0.12  |
| Phosphorus                                 |                        |       |       |       |
| Pinto                                      | 0.05                   | 0.03  | 0.02  | 0.07  |
| Sunbird                                    | 0.03                   | 0.03  | 0.02  | 0.04  |
| Saab                                       | 0.02                   | 0.01  | <0.01 | <0.01 |
| Marquis                                    | 0.02                   | 0.01  | 0.01  | 0.01  |
| Sulfur<br>(Average for Fuels 2 and 3 Only) |                        |       |       |       |
| Pinto                                      | 0.65                   | 8.69  | 9.87  | 0.13  |
| Sunbird                                    | 0.02                   | 0.03  | 0.03  | <0.01 |
| Saab                                       | 0.07                   | 0.02  | 0.01  | <0.01 |
| Marquis                                    | 0.47                   | 5.52  | 9.87  | 0.22  |

TABLE 37. FTP TEST CYCLE EVALUATIONS  
FOR METALS AND OTHER ELEMENTS

| Vehicle    | Emission Rates (mg/km) |                |
|------------|------------------------|----------------|
|            | Cold Start UDDS        | Hot Start UDDS |
| Alumimun   |                        |                |
| Pinto      | 0.03                   | 0.02           |
| Sunbird    | 0.01                   | 0.02           |
| Saab       | 0.12                   | 0.03           |
| Marquis    | 0.05                   | 0.01           |
| Barium     |                        |                |
| Pinto      | 0.12                   | 0.09           |
| Sunbird    | 0.07                   | 0.07           |
| Saab       | 0.07                   | 0.01           |
| Marquis    | 0.06                   | 0.01           |
| Calcium    |                        |                |
| Pinto      | 0.02                   | 0.01           |
| Sunbird    | 0.02                   | 0.02           |
| Saab       | 0.02                   | 0.01           |
| Marquis    | 0.03                   | 0.01           |
| Magnesium  |                        |                |
| Pinto      | 0.03                   | 0.02           |
| Sunbird    | 0.02                   | 0.02           |
| Saab       | 0.03                   | 0.02           |
| Marquis    | 0.02                   | <0.01          |
| Phosphorus |                        |                |
| Pinto      | 0.05                   | 0.03           |
| Sunbird    | 0.04                   | 0.03           |
| Saab       | 0.04                   | 0.01           |
| Marquis    | 0.03                   | 0.01           |
| Iron       |                        |                |
| Pinto      | 1.86                   | 0.77           |
| Sunbird    | 0.29                   | 0.24           |
| Saab       | 2.86                   | 0.31           |
| Marquis    | 2.11                   | 0.37           |

The average barium, magnesium, and phosphorus emission rates were highest for the Pinto and Sunbird vehicles and for the NYCC test cycle. These emission rates did not vary with fuel, and showed a slight increase with increasing mileage. As was the case for aluminum, the Pinto, Saab, and Marquis cold start barium, magnesium, and phosphorous emission rates were higher than the hot start emission rates (Table 37). Barium, magnesium, and phosphorous were also found by X-ray to be present in the lubricant used in this project.

Calcium was found in approximately 50 percent of the filters analyzed. The four vehicles gave approximately the same calcium emission rates and the NYCC test cycle gave only slightly higher emission rates than the other test cycles (Table 35). There were no observable mileage or fuel trends in the calcium emission rates. The cold start emission rates were slightly higher than the hot start emission rates (Table 37).

The Sunbird and Saab gave the highest chlorine vehicle emission rates. The FTP test cycle gave the highest test cycle emission rates. The average chlorine emission rates for fuels 1 and 2 were 3 to 216 times as large as the emission rates for fuel 3. This indicates a chlorine impurity in fuels 1 and 2. Chlorine was also found in the lubricant used in this project. The chlorine emission rates increased with increasing mileage. The cold start chlorine emission rates were higher than the hot start chlorine emission rates for the Pinto, Saab, and Marquis and lower for the Sunbird.

The sulfur emission rates are very similar to the sulfate emission rates discussed previously. The average sulfur emission rates for fuels 2 and 3 (0.03 weight percent sulfur) with respect to vehicle and test cycle are shown in Table 36. The Pinto and Marquis have emission rates over two orders of magnitude higher for the SET and HFET test cycles and over one order of magnitude higher for the FTP and NYCC test cycles than the Sunbird and Saab. As was the case for the sulfate emission rates, there was no significant difference in the low sulfur content fuel 1 (0.003 weight percent sulfur) emission rates and the fuel 2 and 3 (0.03 weight percent sulfur) emission rates for the Sunbird and Saab. The Pinto and Marquis, however, had emission rates, that were much larger for fuels 2 and 3 (3 to 8 times larger from the Pinto; 10 to 100 times larger from the Marquis) than for fuel 1. No definite trends in emission rate were found with increasing mileage accumulation. The cold and hot start sulfur emission rates also parallel the sulfate emission rates with the Pinto and Marquis giving higher hot start sulfur emission rates and the Sunbird and Saab giving higher cold start sulfur emission rates. Sulfur was also found in the lubricant used in this project.

#### UNDILUTED EXHAUST OXYGEN CONCENTRATIONS

The average oxygen concentrations measured in this project are listed in Table 38. The Pinto and Marquis, which both have auxillary air supplied between the three-way catalyst and the addition oxidation catalyst, have much higher undiluted oxygen concentrations than either the Sunbird or Saab, which have no additional air supplied to the catalyst. The oxygen concentration

TABLE 38. AVERAGE UNDILUTED EXHAUST OXYGEN CONCENTRATIONS

Vehicle and Test Cycle Comparison

| Vehicle | Undiluted Exhaust Concentration (percent) |      |      |      |
|---------|-------------------------------------------|------|------|------|
|         | FTP                                       | SET  | HFET | NYCC |
| Pinto   | 7.57                                      | 7.25 | 6.66 | 8.29 |
| Sunbird | 3.01                                      | 1.86 | 0.72 | 4.28 |
| Saab    | 1.24                                      | 0.62 | 0.18 | 1.54 |
| Marquis | 6.52                                      | 6.50 | 5.85 | 6.57 |

FTP Test Cycle Evaluation

| Vehicle | Undiluted Exhaust Concentration (percent) |               |               |               |
|---------|-------------------------------------------|---------------|---------------|---------------|
|         | Cold Start                                |               | Hot Start     |               |
|         | Cold Start 505                            | Stabilize 867 | Hot Start 505 | Stabilize 867 |
| Pinto   | 7.3                                       | 7.6           | 7.5           | 7.7           |
| Sunbird | 2.6                                       | 3.1           | 2.9           | 3.2           |
| Saab    | 1.4                                       | 1.2           | 1.2           | 1.2           |
| Marquis | 6.1                                       | 6.5           | 6.6           | 6.7           |

appears to increase with decreasing average speed of the test cycle. The HFET test cycle, which has the highest average test cycle speed (77.6 km/hr) has the lowest oxygen concentrations. The NYCC which has the lowest average test cycle speed (11.5 km/hr) has the highest oxygen concentrations. The second part of Table 38 lists the average oxygen concentrations for each segment of the four segment FTP. The average oxygen concentration remains relatively constant throughout the FTP test cycle.

#### AVERAGE CARBON DIOXIDE EMISSION RATES

The emission rates for carbon dioxide are listed in Table 39. The eight-cylinder Marquis gives the highest carbon dioxide emission rates (reflects the higher fuel consumption of the Marquis). The test cycle carbon dioxide emission rates follow the same trend as oxygen, with the carbon dioxide emission rate increasing (HFET<SET<FTP<NYCC) as the test cycle average speed decreases (HFET>SET>FTP>NYCC). The second part of Table 39 lists the carbon dioxide emission rates for each segment of the four segment FTP. The cold start 505 segment emission rates are higher than the hot start 505 emission rates and the cold start stabilize 867 emission rates are higher than the hot start stabilize 867 emission rates.

In high concentrations carbon dioxide can paralyze the respiratory center. Because of this possibility, it is considered an industrial hazard and OSHA and the ACGIH have established TLV concentrations of 5000 ppm (9.15 g/m<sup>3</sup>) for carbon dioxide. The carbon dioxide emission rates in the first part of Table 39 give undiluted exhaust concentrations ranging from 209 to 248 g/m<sup>3</sup>. The values exceed the TLV by factors of 23 to 27. If these levels are inserted into the model situation described for CO and NO<sub>x</sub>, commuter exposure concentrations of 0.13 to 0.15 g/km are obtained. The levels are 0.01 to 0.02 times the TLV concentration.

#### FUEL CONSUMPTION

The fuel consumption as a function of vehicle and test cycle, fuel, mileage and cold versus hot start operation is presented in Table 40. The fuel consumption is directly related to the carbon dioxide emission rates and therefore a discussion for either is similar. The eight-cylinder Marquis has the highest vehicle fuel consumption rate. The low speed NYCC test cycle has the highest test cycle fuel consumption rate followed in order by the FTP, SET and HFET test cycles. The fuel consumption for the FTP test cycles as a function of fuel are shown in the second part of Table 40. The rates are similar with two vehicles having higher consumption rates with fuels 1 and 2 (identical except for sulfur content) and two with higher rates with fuel 3. The vehicles all showed a decrease in fuel consumption (third part of Table 40) with increasing mileage. The decrease occurred only after the third 5000 mile accumulation for the Pinto and Sunbird. The cold start 505 and cold start stabilize 867 segments of the FTP test cycle had higher fuel consumption rates than their hot start counterparts.



TABLE 39. AVERAGE CARBON DIOXIDE EMISSION RATES

Vehicle and Test Cycle Comparison

| Vehicle | Emission Rates (g/km) |     |      |      |
|---------|-----------------------|-----|------|------|
|         | FTP                   | SET | HFET | NYCC |
| Pinto   | 260                   | 212 | 192  | 479  |
| Sunbird | 242                   | 195 | 176  | 405  |
| Saab    | 262                   | 220 | 205  | 414  |
| Marquis | 372                   | 281 | 249  | 696  |

FTP Test Cycle Evaluation

| Vehicle | Emission Rate (g/km) |               |               |               |
|---------|----------------------|---------------|---------------|---------------|
|         | Cold Start 505       | Cold Start    |               | Hot Start     |
|         |                      | Stabilize 867 | Hot Start 505 | Stabilize 867 |
| Pinto   | 266                  | 268           | 240           | 263           |
| Sunbird | 255                  | 247           | 222           | 243           |
| Saab    | 287                  | 258           | 251           | 248           |
| Marquis | 401                  | 377           | 340           | 374           |

TABLE 40. AVERAGE FUEL CONSUMPTION

## Vehicle and Test Cycle Comparisons

| Vehicle | Fuel Consumption l/100 km |       |       |       |
|---------|---------------------------|-------|-------|-------|
|         | FTP                       | SET   | HFET  | NYCC  |
| Pinto   | 11.22                     | 9.02  | 8.15  | 20.47 |
| Sunbird | 10.66                     | 8.34  | 7.53  | 17.41 |
| Saab    | 11.25                     | 9.41  | 8.75  | 17.73 |
| Marquis | 15.85                     | 11.94 | 10.59 | 29.63 |

## Fuel Comparisons

| Vehicle | Test Cycle | Fuel Consumption l/100 km |        |
|---------|------------|---------------------------|--------|
|         |            | Avg Fuel 1 and 2          | Fuel 3 |
| Pinto   | FTP        | 11.32                     | 11.18  |
| Sunbird | FTP        | 10.72                     | 10.67  |
| Saab    | FTP        | 11.19                     | 11.39  |
| Marquis | FTP        | 15.82                     | 15.91  |

## Mileage Comparisons

| Vehicle | Test Cycle | Fuel Consumption l/100 km |                                |                                 |                                |
|---------|------------|---------------------------|--------------------------------|---------------------------------|--------------------------------|
|         |            | Initial                   | After First<br>5000 mile Accum | After Second<br>5000 mile Accum | After Third<br>5000 mile Accum |
| Pinto   | FTP        | 11.20                     | 11.32                          | 11.38                           | 10.98                          |
| Sunbird | FTP        | 10.63                     | 10.87                          | 10.68                           | 10.45                          |
| Saab    | FTP        | 11.50                     | 11.18                          | 11.13                           | 11.21                          |
| Marquis | FTP        | 16.80                     | 15.81                          | 15.41                           | 15.39                          |

## FTP Test Cycle Evaluation

| Vehicle | Fuel Consumption l/100 km |                             |               |                            |
|---------|---------------------------|-----------------------------|---------------|----------------------------|
|         | Cold Start 505            | Cold Start<br>Stabilize 867 | Hot Start 505 | Hot Start<br>Stabilize 867 |
| Pinto   | 12.04                     | 11.40                       | 10.25         | 11.18                      |
| Sunbird | 12.03                     | 10.54                       | 9.76          | 10.38                      |
| Saab    | 12.54                     | 11.01                       | 10.76         | 10.59                      |
| Marquis | 17.24                     | 16.01                       | 14.48         | 15.88                      |

## EXHAUST AND FUEL SULFUR

If all of the exhaust compounds that contained sulfur were accounted for in this project, then the mg of sulfur consumed in the fuel should equal the mg of sulfur in the exhaust. Table 41 lists the average mg of fuel sulfur consumed and the average weights (mg) of exhaust sulfur from sulfate, sulfur dioxide and the organic sulfides plus hydrogen sulfide for each vehicle and test cycle. The percent of the fuel sulfur found in the exhaust is also listed in Table 41. In the FTP and NYCC test cycles only 33 to 61 percent of the consumed sulfur was detected in exhaust. Of the amount detected 98 percent was in the form of sulfur dioxide. Either there is sulfur storage on the catalysts for these test cycles or an unanalyzed sulfur compound is present in exhaust. In the SET and HFET test cycles 64 to 133 percent of the consumed sulfur was detected in exhaust. Sulfur from sulfur dioxide made up 99 percent of this sulfur for the Sunbird and Saab, but only 65 percent for the Pinto and Marquis. Sulfur from sulfate made up most of the remaining 35 percent of the detected sulfur from the Pinto and Marquis SET and HFET test cycles. Sulfur recoveries of greater than 100 percent for the SET and HFET test cycles indicate the possibility of sulfur being stored in the catalyst during previous test cycles and coming off during the SET and HFET test cycles.

TABLE 41. FUEL SULFUR VERSUS EXHAUST SULFUR  
(Average for Fuels 2 and 3 Only)

| Vehicle | Test Cycle | Fuel Sulfur Consumed Per Test (mg) | Exhaust Sulfur (mg) |                |                                     | Percent of Fuel Sulfur Found in Exhaust |
|---------|------------|------------------------------------|---------------------|----------------|-------------------------------------|-----------------------------------------|
|         |            |                                    | Sulfate             | Sulfur Dioxide | Organic Sulfides + Hydrogen Sulfide |                                         |
| Pinto   | FTP        | 25.2                               | 0.48                | 13.17          | 0.05                                | 54                                      |
| Sunbird | FTP        | 23.9                               | 0.02                | 7.72           | 0.08                                | 33                                      |
| Saab    | FTP        | 25.1                               | 0.05                | 15.04          | 0.18                                | 61                                      |
| Marquis | FTP        | 35.1                               | 0.38                | 12.45          | 0.15                                | 37                                      |
| Pinto   | SET        | 20.2                               | 6.83                | 14.92          | 0.08                                | 108                                     |
| Sunbird | SET        | 18.8                               | 0.02                | 17.27          | 0.06                                | 92                                      |
| Saab    | SET        | 21.2                               | 0.02                | 13.34          | 0.12                                | 64                                      |
| Marquis | SET        | 26.7                               | 4.79                | 18.62          | 0.08                                | 88                                      |
| Pinto   | HFET       | 18.3                               | 8.81                | 7.84           | 0.05                                | 91                                      |
| Sunbird | HFET       | 16.8                               | 0.02                | 22.34          | 0.05                                | 133                                     |
| Saab    | HFET       | 19.6                               | 0.01                | 18.75          | 0.11                                | 96                                      |
| Marquis | HFET       | 23.6                               | 7.18                | 9.22           | 0.11                                | 70                                      |
| Pinto   | NYCC       | 46.0                               | 0.28                | 25.04          | 0.34                                | 56                                      |
| Sunbird | NYCC       | 38.6                               | 0.03                | 20.20          | 0.35                                | 53                                      |
| Saab    | NYCC       | 39.4                               | 0.11                | 18.19          | 0.36                                | 47                                      |
| Marquis | NYCC       | 65.9                               | 0.21                | 28.77          | 0.85                                | 45                                      |

## SECTION 6

### SUMMARY AND CONCLUSIONS

Regulated and unregulated exhaust emissions have been characterized for four vehicles designed for low NO<sub>x</sub> emissions. Emission rates of regulated and several unregulated pollutants were monitored as to vehicle, test cycle, fuel, increasing vehicle mileage, and cold versus hot start operation. Data has been grouped, averaged and compared to reveal differences in pollutant emission rate as to type of catalyst (three-way + oxidation versus three-way catalyst), test cycle, fuel, increasing vehicle mileage, and cold versus hot start operation. Where appropriate, a comparison of the undiluted exhaust concentration with TLV established by OSHA and the ACGIH has been carried out to provide some means of comparison as to the relative magnitude of the emission rate. Pollutants which have undiluted exhaust concentration that exceed the TLV do not necessarily indicate a health problem as the emissions will be diluted before reaching a receptor.

Numerous differences were observed in pollutant emission rates as to vehicle. Many of the differences were unique to the individual emission systems, however, several differences could be grouped according to the catalyst type. The following differences in emission rates have been observed between the three-way + oxidation (Pinto and Marquis) and three-way catalyst (Sunbird and Saab) systems.

1. Systems with three-way + oxidation catalysts give higher emission rates for hydrocarbons - NYCC test cycle, formaldehyde and sulfate.
2. Methane and ethane make up a larger percentage of the total hydrocarbon emission rate in the three-way + oxidation catalyst systems.
3. Three-way systems give higher emission rates for carbon monoxide - SET and HFET test cycles, isobutyraldehyde, and cyanide.
4. Ethylene, acetylene, propylene, benzene and toluene make up a larger percentage of the total hydrocarbon emission rates in the three-way systems.

Emission rate differences as to test cycle can be observed for several pollutants. In many cases the SET and HFET test cycles give similar emission rates and are grouped together when comparing rates with the FTP and NYCC test cycles. The SET and HFET test cycles have a higher average speed than the FTP or NYCC test cycles (SET, 56.0 km/hr; HFET, 77.6 km/hr; FTP, 31.4 km/hr; and NYCC, 11.5 km/hr). The FTP test cycle also contains a cold and hot start

whereas the other three test cycles are hot-start test cycles.

1. The SET and HFET test cycles give higher emission rates for  $\text{NO}_x$  and sulfate (Pinto and Marquis only).
2. Methane and ethane make up a larger percentage of the hydrocarbon emissions in the SET and HFET test cycles than in the FTP or NYCC test cycles.
3. Acetylene, propylene, benzene, and toluene make up a larger percentage of the hydrocarbon emission in the FTP than in the other three test cycles.
4. Ethylene makes up a larger percentage of the hydrocarbons in the FTP and NYCC test cycles than in the SET or HFET test cycles.
5. The FTP and NYCC test cycles give higher emission rates for cyanide (Pinto and Marquis only), hydrocarbons and carbon monoxide.
6. The NYCC test cycle gives the highest emission rates for formaldehyde, organic sulfides, nitrous oxide, and ammonia.

The concentrations of nitrous oxide, oxygen, carbon dioxide, methane, (Pinto and Marquis only), and ethane (Pinto and Marquis only) in exhaust decrease as the average speed of the test cycle increases (i.e., the HFET test cycle gives the lowest levels and the NYCC test cycle gives the highest levels) for all four vehicles. This trend was also observed for the fuel consumption for all four vehicles.

Differences in the emission rates for sulfur containing pollutants were observed when using fuels with varying sulfur content. Fuels 2 and 3, which contained 0.03 weight percent sulfur, gave higher emission rates for sulfur dioxide, sulfate, hydrogen sulfide, and sulfur (by x-ray) than did fuel 1, which contained 0.003 weight percent sulfur. However, only the sulfate emission rates reflected the 10-fold difference in fuel sulfur.

Fuel 3 had a higher content of saturates (70 percent for fuel 3 versus 55.7 percent for fuels 1 and 2) and olefins (7.2 percent for fuel 3 versus 6.8 percent for fuels 1 and 2) and a lower aromatic content (22.8 percent for fuel 3 versus 37.5 percent for fuels 1 and 2) than fuels 1 and 2. This difference may account for the higher percentage of methane, ethane, and propylene and the lower percentage of benzene and toluene in the hydrocarbon emissions for fuel 3. Other pollutant emission rates that differ with fuel are  $\text{NO}_x$  and formaldehyde. Fuels 1 and 2 give higher  $\text{NO}_x$  and lower formaldehyde emission rates than fuel 3.

In most cases the emission rates increased with increasing mileage accumulation. The following pollutant emission rates increased with increasing mileage: hydrocarbons, carbon monoxide,  $\text{NO}_x$  (Saab only), benzene percent, formaldehyde, acetaldehyde, hexanaldehyde, nitrous oxide and



cyanide. The percentage of methane (Pinto and Marquis) in the hydrocarbon emission decreased with mileage. The Saab showed a significant decrease in hydrocarbons, carbon monoxide, hydrogen sulfide, ethyl sulfide, dimethyl disulfide and ammonia and an increase in  $\text{NO}_x$  and methane percent from the initial test point to the first mileage accumulation test point. After the first mileage accumulation test point for the Saab, a gradual increase in carbon monoxide and hydrocarbon emission rates and a continued increase in  $\text{NO}_x$  emission rates was observed. The methane percent decreased after this test point.

Emission rates were generally higher for the cold start segment of the FTP test cycle than for the corresponding hot start segment. Below, the pollutants are separated into three columns. The first column lists the pollutants which give higher cold start emission rates, the second column lists pollutants giving equivalent cold and hot start emission rates, and the third column lists pollutants which give higher hot start emission rates.

| <u>Higher Cold Start<br/>Emission Rates</u> | <u>Equivalent<br/>Emission Rates</u> | <u>Higher Hot Start<br/>Emission Rates</u> |
|---------------------------------------------|--------------------------------------|--------------------------------------------|
| hydrocarbons                                | $\text{NO}_x$ (Saab)                 | isobutyraldehyde                           |
| carbon monoxide                             | isobutyraldehyde                     | (except Pinto)                             |
| $\text{NO}_x$ (except Saab)                 | (Pinto)                              | monomethylamine                            |
| all individual hydrocarbons                 | monomethylamine                      | (Saab)                                     |
| formaldehyde                                | (Pinto)                              | monethyl + dimethylamine (Saab)            |
| acetaldehyde                                | trimethylamine                       | trimethylamine                             |
| monomethylamine                             | (except Saab)                        | (Saab)                                     |
| (Sunbird, Marquis)                          | dimethyl disulfide                   | hydrogen sulfide                           |
| monoethyl + dimethylamine                   | (Pinto, Marquis)                     | (Saab)                                     |
| (except Saab)                               | barium (Sunbird)                     | methyl sulfide                             |
| carbonyl sulfide                            | calcium (Sunbird)                    | (except Pinto)                             |
| methyl sulfide (Pinto)                      | magnesium (Sunbird)                  | sulfur dioxide                             |
| ethyl sulfide                               |                                      | (Sunbird, Marquis)                         |
| dimethyl disulfide                          |                                      | sulfate (Pinto,                            |
| (Pinto, Saab)                               |                                      | Marquis)                                   |
| sulfur dioxide (Pinto,                      |                                      | ammonia (Pinto,                            |
| Saab)                                       |                                      | Saab)                                      |
| Sulfate (Sunbird, Saab)                     |                                      | nitrous oxide                              |
| total cyanide                               |                                      | (except Sunbird)                           |
| ammonia (Sunbird, Marquis)                  |                                      | aluminum (Sunbird)                         |
| nitrous oxide (Sunbird)                     |                                      | oxygen (except Saab)                       |
| aluminum (except Sunbird)                   |                                      |                                            |
| barium (except Sunbird)                     |                                      |                                            |
| calcium (except Sunbird)                    |                                      |                                            |
| phosphorus                                  |                                      |                                            |
| iron                                        |                                      |                                            |
| oxygen (except Saab)                        |                                      |                                            |
| carbon dioxide                              |                                      |                                            |

The following additional differences have also been observed for the different segments of the FTP test cycle.

1. The hydrocarbon percentages of benzene (Pinto and Marquis), ethylene, acetylene, propylene, and toluene were higher in the cold start 505 segment than the percentages in the hot start 505 segment.
2. The hydrocarbon percentages of methane, ethane, propane, and benzene (Sunbird and Saab) were higher in the hot-start 505 segment than the percentages in the cold-start 505 segment.
3. Hydrocarbon, carbon monoxide, and carbon dioxide cold-start stabilize 867 emission rates were higher than the hot-start stabilize 867 emission rates (hydrocarbons and carbon monoxide - Sunbird, Saab, and Marquis only).
4.  $\text{NO}_x$ , nitrous oxide, and oxygen hot-start stabilize emission rates were higher than the cold-start stabilize 867 emission rates ( $\text{NO}_x$  and oxygen - Pinto, Sunbird, and Marquis only. Nitrous oxide - Pinto, Saab and Marquis only).

A comparison of the undiluted exhaust concentrations with the TLV revealed several unregulated pollutants that exceeded the TLV concentrations. Formaldehyde (Marquis), 1.5 times the TLV, sulfur dioxide, 1.2 to 4.7 times the TLV, sulfate (as sulfuric acid, Pinto and Marquis) 12.5 to 32.0 times the TLV, and ammonia (Saab at initial test point), 2 to 8 times the TLV, were found to exceed the TLV. Benzene, formaldehyde, (Pinto, Sunbird, Saab), total cyanide, and ammonia were found at concentrations from 0.1 TLV to 1 TLV. Acetaldehyde, organic amines, hydrogen sulfide and organic sulfides were found at concentrations less than 0.1 TLV.

The regulated emissions, carbon monoxide and  $\text{NO}_x$ , and carbon dioxide, (often considered non-toxic) concentrations, however, also exceeded the TLV concentrations set by OSHA and ACGIH. Carbon monoxide exceeded the TLV by a factor of 1 to 77,  $\text{NO}_x$  by a factor of 22 to 108, and carbon dioxide by a factor of 23 to 27. Sulfate is the only unregulated emission that is comparable to the regulated and carbon dioxide concentrations in exceeding the TLV.

The highest average undiluted exhaust concentration for each compound that exceeded its TLV concentration was inserted into a model exposure situation to determine commuter exposure levels at high traffic density, parallel wind, and neutral stability. The exposure levels for each of the compounds is listed below:

|                 |            |
|-----------------|------------|
| $\text{NO}_x$   | 0.07 TLV   |
| carbon monoxide | 0.05 TLV   |
| carbon dioxide  | 0.02 TLV   |
| sulfate         | 0.02 TLV   |
| ammonia         | 0.01 TLV   |
| sulfur dioxide  | 0.003 TLV  |
| formaldehyde    | 0.0009 TLV |

All pollutant levels are below the TLV values set by OSHA and ACGIH and represent a 1000 to 1 dilution. Based on the TLV criteria, the concentrations of the regulated carbon monoxide and NO<sub>x</sub> appear to be most significant in this project. Sulfate and ammonia concentrations appear to be the next in significance. This evaluation, however, does not take into account evaluations for carcinogenicity, continuous exposure (24 hours instead of an 8 hour working day), cumulative, synergistic, or indirect effects.

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## APPENDIX A

### GENERAL INFORMATION

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APPENDIX A-1. MODIFIED DURABILITY DRIVING SCHEDULE FOR  
MILEAGE ACCUMULATION ON PUBLIC ROADS

The following schedule is shown on Figure A-1.

1. Leave Institute Fleet Laboratory
2. Proceed to CULEBRA ROAD via INSTITUTE ROAD, 20 & 30 m.p.h.
3. Stop at CULEBRA
4. Left turn onto CULEBRA and proceed to "A", 410, at 40 m.p.h. (Distance from Fleet Laboratory to "A" is 2.3 miles)
5. Stop at "A", idle 15 secs.
6. Start lap prompter at 1.
7. Accelerate from stop, turn left on access road
8. After left turn, accelerate to lap speed and then decelerate at "B" to 20 m.p.h., as traffic permits.
9. Accelerate to lap speed as you turn onto 410. Continue on 410 to next exit and then decelerate at "C" to 20 m.p.h., as traffic permits then accelerate to lap speed.
10. Continue on FRONTAGE ROAD until a full stop can be safely made at area of point "D". Idle for 15 secs.
11. Accelerate from stop to lap speed and pull onto 410 at next ramp. Continue on 410 to next exit ramp.
12. Take exit, then decelerate to 20 m.p.h., at "E".
13. Accelerate to lap speed.
14. Stop at "F" and idle 15 secs.
15. Accelerate to lap speed and continue to "G". Decelerate to 20 m.p.h., at "G" then accelerate to lap speed.
16. Stop at traffic light if red, "H" (this can be as long as 33 secs.) If the light is green, proceed and make an additional stop along the North lap as traffic permits.
17. As you pass "H" stop light, push the "lap" prompter and observe the "lap speed".



APPENDIX A-1 (Cont'd). MODIFIED DURABILITY DRIVING SCHEDULE FOR  
MILEAGE ACCUMULATION ON PUBLIC ROADS

18. Left turn on MARBACH under 410. Stop at light "I". If light is green, proceed on North lap and make additional stop as traffic permits.
19. Left turn to 410 access at "I".
20. Proceed up 410 to "J" at lap speed.
21. Decelerate at "J" to 20 m.p.h., and then accelerate to lap speed.
22. Continue to "K" at lap speed.
23. Decelerate at "K" to 20 m.p.h., and then accelerate to lap speed.
24. Take ramp to 410 and proceed up 410 to exit ramp at "L".
25. Decelerate at "L" to 20 m.p.h., then accelerate to lap speed.
26. Proceed to "M", then stop and idle 15 secs.
27. Accelerate to lap speed then decelerate at "N" to 20 m.p.h., and then accelerate to lap speed.
28. Take ramp to 410 and continue on 410 to CULEBRA exit ramp.
29. Take CULEBRA exit to stop at "A". Idle 15 secs.
30. Push "lap" prompter for next lap and lap speed.
31. This begins the 3rd lap.
32. Continue with South lap - North lap sequence until lap number 9 is complete.
33. Lap number 10 is run at a steady 55 m.p.h., on 410. Get on 410 at first entrance ramp following the stop at the end of lap number 9 and stay on 410.
34. Lap 10 is completed when you stop at "A" or "H" after pulling off onto the ramp nearest the stop.
35. After stop at "A" or "H" lap number 10 is complete.
36. Punch lap button for lap 11.
37. Accelerate then stop at "B".
38. Accelerate to lap speed then decelerate to stop at "D".

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APPENDIX A-1 (Cont'd). MODIFIED DURABILITY DRIVING SCHEDULE FOR  
MILEAGE ACCUMULATION ON PUBLIC ROADS

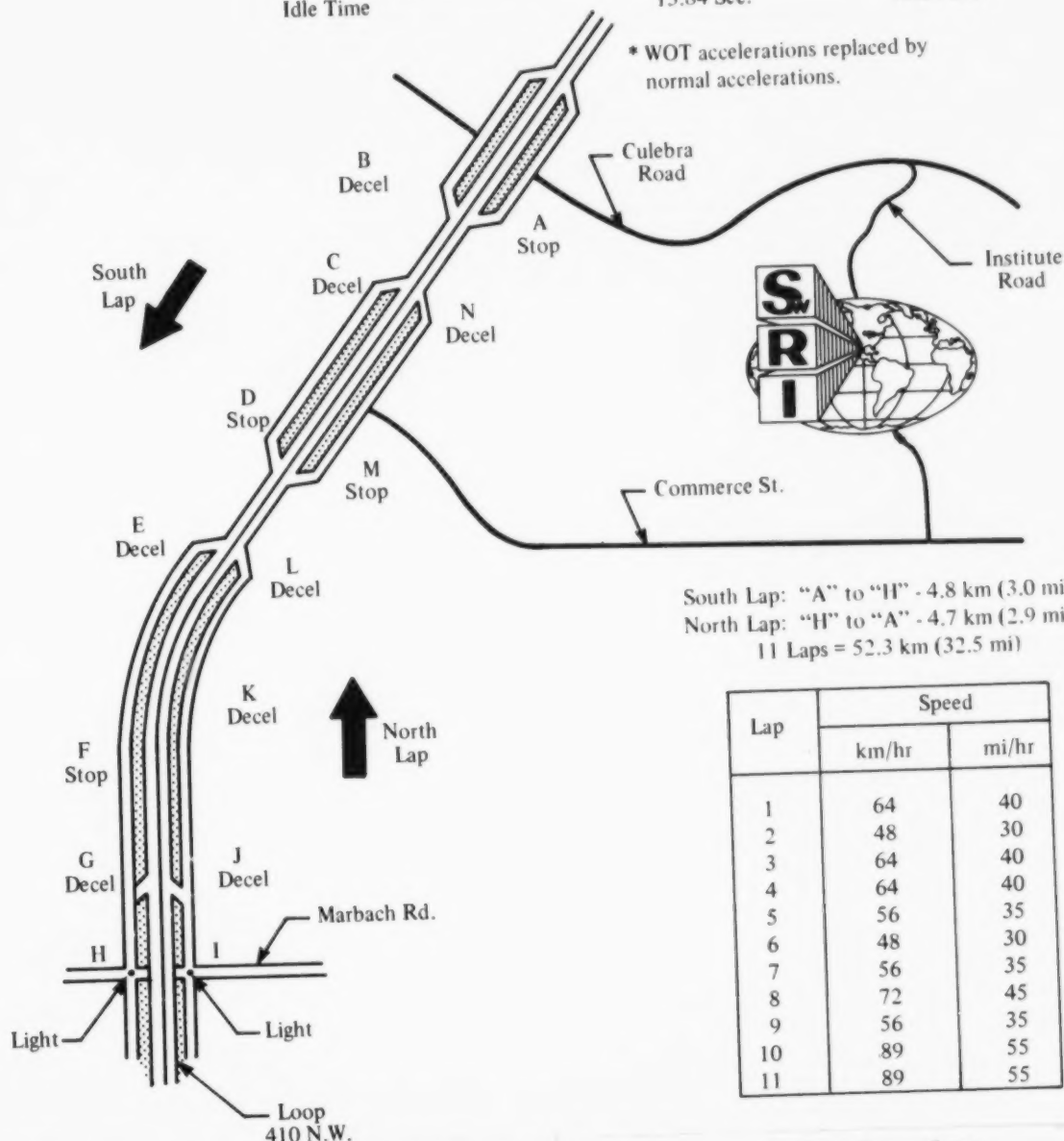
39. Accelerate to lap speed then decelerate to stop at "F".
40. Accelerate to lap speed then decelerate to stop at "H".
41. This completes one cycle of the mileage accumulation.
42. The next cycle of the schedule begins at "H".
43. Complete as many steps per shift as time will allow, then return to Fleet Laboratory.

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| Driving Mode                                           | Events Per Mile  |            |
|--------------------------------------------------------|------------------|------------|
|                                                        | 55 mph Top Speed |            |
|                                                        | SwRI Course*     | AC No. 37  |
| Stops                                                  | 1.02             | 1.01       |
| Normal Accelerations from Stop                         | 1.01             | 0.91       |
| Normal Accelerations from 20 mph                       | 1.11             | 1.11       |
| Wide-Open Throttle Accelerations and Fast Deceleration | 0.00             | 0.10       |
| Idle Time                                              | 13.84 Sec.       | 13.64 Sec. |

\* WOT accelerations replaced by normal accelerations.



| Lap | Speed |       |
|-----|-------|-------|
|     | km/hr | mi/hr |
| 1   | 64    | 40    |
| 2   | 48    | 30    |
| 3   | 64    | 40    |
| 4   | 64    | 40    |
| 5   | 56    | 35    |
| 6   | 48    | 30    |
| 7   | 56    | 35    |
| 8   | 72    | 45    |
| 9   | 56    | 35    |
| 10  | 89    | 55    |
| 11  | 89    | 55    |

Appendix A-1. Modified Alternate Mileage Accumulation Procedure

## APPENDIX A-2. CALCULATIONS FOR UNREGULATED EMISSIONS

This appendices documents the calculational methods used for the unregulated emissions. All values not defined (i.e., CVS FLOW, VOL, etc) are obtained from the computer printouts for the regulated emissions. Example printout is included as Table 1.

### A. Individual Hydrocarbons, Nickel Carbonyl ( $\text{Ni}(\text{CO})_4$ ) and nitrous oxide ( $\text{N}_2\text{O}$ ).

- For FTP Evaluations only, convert 2-Bag UDSS to Equivalent 1-Bag UDSS

$$\text{PPM}_{12} = \frac{\text{PPM}_1 \times \text{CVS FLOW}_1 + \text{PPM}_2 \times \text{CVS FLOW}_2}{\text{CVS FLOW}_1 + \text{CVS FLOW}_2}$$

$$\text{PPM}_{34} = \frac{\text{PPM}_3 \times \text{CVS FLOW}_3 + \text{PPM}_4 \times \text{CVS FLOW}_4}{\text{CVS FLOW}_3 + \text{CVS FLOW}_4}$$

- Convert PPM to  $\mu\text{g}/\text{m}^3$ :

$$\mu\text{g}/\text{m}^3 = 35.32 \times \text{DENSITY} \times \text{PPM}$$

| Density, g/ft <sup>3</sup>       |          |                                  |         |
|----------------------------------|----------|----------------------------------|---------|
| Methane $\text{CH}_4$            | - 18.86  | Propane $\text{C}_3\text{H}_8$   | - 17.29 |
| Ethylene $\text{C}_2\text{H}_4$  | - 16.50  | Propylene $\text{C}_3\text{H}_6$ | - 16.50 |
| Ethane $\text{C}_2\text{H}_6$    | - 17.68  | Benzene $\text{C}_6\text{H}_6$   | - 15.33 |
| Acetylene $\text{C}_2\text{H}_2$ | - 15.33  | Toluene $\text{C}_7\text{H}_8$   | - 15.49 |
| Ni(CO) <sub>4</sub>              | - 200.99 | N <sub>2</sub> O                 | - 51.82 |

- The procedures for aldehydes and ketones, organic sulfides, organic amines, sulfur dioxide, ammonia, hydrogen sulfide, total cyanide and sulfate give concentration in  $\mu\text{g}/\text{m}^3$ .

### C. Calculation of mg/km

$$\text{mg}/\text{km} = ((\text{EXH} \times \text{SCF} - \text{BG} \times \text{DFC}) \times \text{VOL} \div \text{KM}) \div 1000$$

- Calculations were performed using a Hewlett Packard HP-65 Programmable Calculator
- Dry (DFC) and (SCF) were used for all unregulated emissions except: IHC,  $\text{N}_2\text{O}$  and  $\text{Ni}(\text{CO})_4$
- DFC and SCF are obtained from the computer printout for regulated emissions. (SEE Tables 1 and 2)

APPENDIX A-2 (CONT'D). CALCULATIONS FOR UNREGULATED EMISSIONS

D. Metals and Other Elements

$$\text{COMPONENT WEIGHT ON FILTER} = \mu\text{g}/\text{cm}^2 \times \text{EFF. FILTER AREA}$$

$$\text{EFF. FILTER AREA} = 14.3 \text{ cm}^2$$

$$\text{COMPONENT } \mu\text{g}/\text{m}^3 = \text{C.W.O.F.} \div \text{TOTAL WT.} \times (\mu\text{g}/\text{m}^3 \text{ for Total Wt.})$$

E. Calculation of Average Oxygen

$$\text{Average} = \frac{\text{INTEGRATOR COUNTS}}{6.944 \times \text{SECONDS}} \times \text{FULL SCALE VALUE}$$

$$= \% \text{ For Oxygen}$$

F. Calculation for 4-FTP

$$\text{Composite 4-FTP} = 0.43 \times (\text{Value for 1\&2}) + 0.57 \times (\text{Value for 3\&4})$$

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APPENDIX A-2 (CONT'D). CALCULATIONS FOR UNREGULATED EMISSIONS

TABLE 2. DEFINITION OF COMPUTER PRINTOUT NOMENCLATURE

FOUR FOUR-BAG AND SINGLE-BAG  
REGULATED EMISSIONS

The following are primarily excerpts taken from the computer program:

```

C   DFC = DILUTION FACTOR CORRECTION DFC = FOR WET SAMPLES  DFC12 = FOR DRY
    DF(J)=13.4/( YC2(2,J) +(( YH(2,J) ÷ CC(2,J))/10000.))
    DFC(J) = 1 - 1/DF(J)

C   CALCULATE DFC, VOL, KM FOR BAGS 1+2 AND 3+4
C   DF = TOTAL CVS FLOW / EXHAUST FLOW = AIR + EXH / EXH
C   DFC = 1 - 1/DF = 1 - EXH/(AIR+EXH) = AIR/(AIR+EXH)
    DFC12 = (DFC(1)*VMIX(1) + DFC(2)*VMIX(2)) / (VMIX(1) + VMIX(2))
    DFC34 = (DFC(3)*VMIX(3) + DFC(4)*VMIX(4)) / (VMIX(3) + VMIX(4))
    IF(RH.LT.20) RH = 20
    DFC12 = DFC12 * (1.0 - 0.000323*(RH - 20))
    DFC34 = DFC34 * (1.0 - 0.000323*(RH - 20))

C   SCF = SAMPLE CORRECTION FACTOR FOR WATER REMOVAL  SCF = FOR WET  SCFD=DRY
    SCF12 = 1.000
    SCF34 = 1.000
    SCFD12 = (SCFD(1)*VMIX(1)+SCFD(2)*VMIX(2)) / (VMIX(1) + VMIX(2))
    SCFD34 = (SCFD(3)*VMIX(3)+SCFD(4)*VMIX(4)) / (VMIX(3) + VMIX(4))

TOTAL FUEL SULFUR:

C   TFS = TOTAL FUEL SULFUR IN MG/KM
C   TFS = L/100KM * PCT * G/ML * 100ML/L * 0.10G/GPCT * 1000MG/G
    TFS = CBFM * FSWPCT * FPPG * 100.

C   CALCULATE 4-BAG EMISSIONS AND FUEL CONSUMPTION
C   4-BAG = 0.43*(BAG1+BAG2)/(MILES1+MILES2)+0.57*(BAG3+BAG4)/(MILES3+MILES4)
    DISTA=MILES(1) + MILES(2)
    DISTB=MILES(2) + MILES(3)
    DISTC=MILES(3) + MILES(4)
    HCWM4 = 0.43*((HCM(1)+HCM(2)) / DISTA) + 0.57*((HCM(3)+HCM(4)) / DISTC)
    COWM4 = 0.43*((COM(1)+COM(2)) / DISTA) + 0.57*((COM(3)+COM(4)) / DISTC)
    CO2WM4= 0.43*((CO2M(1)+CO2M(2))/DISTA) + 0.57*((CO2M(3)+CO2M(4)) / DISTC)
    NOXWM4= 0.43*((NOXM(1)+NOXM(2))/DISTA) + 0.57*((NOXM(3)+NOXM(4)) / DISTC)
    CBFE4 = 2421. / (.866*HCWM4 ÷ .429*COWM4 + .273*CO2WM4)

```



APPENDIX B  
INDIVIDUAL TEST RESULT SUMMARY TABLES

Table B-1. Car 21, Fuel No. 1, Initial Mileage

|                              | EMISSION RATE, MG/KM (Except as Noted) |        |        |        |        |        |        |        |     |  |
|------------------------------|----------------------------------------|--------|--------|--------|--------|--------|--------|--------|-----|--|
|                              | FTP                                    |        | SET    |        | HFET   |        | NVCC   |        | SET |  |
| Test Number,                 | 210111                                 | 210112 | 210113 | 210114 | 210121 | 210122 | 210123 | 210124 |     |  |
| Barometer, mm Hg             | 747.3                                  | 747.5  | 747.5  | 741.7  | 740.7  | 740.4  | 740.2  | 741.7  |     |  |
| Humidity, g/kg               | 4.2                                    | 4.5    | 5.6    | 9.9    | 7.5    | 6.5    | 8.8    | 10.6   |     |  |
| Temperature, °C              | 22.2                                   | 25.6   | 27.2   | 25.0   | 24.4   | 28.3   | 27.8   | 25.0   |     |  |
| Total Fuel Sulfur, mg/km     | 0.88                                   | 0.71   | 0.64   | 1.43   | 0.86   | 0.70   | 0.64   | 1.58   |     |  |
| Carbon Dioxide, g/km         | 270.1                                  | 221.2  | 198.7  | 441.4  | 263.2  | 218.3  | 200.3  | 488.4  |     |  |
| Fuel Cons., l/100 km         | 11.69                                  | 9.45   | 8.49   | 18.96  | 11.37  | 9.33   | 8.55   | 21.01  |     |  |
| <u>Regulated Emissions</u>   |                                        |        |        |        |        |        |        |        |     |  |
| Hydrocarbons (THC), g/km     | 0.17                                   | 0.02   | 0.02   | 0.19   | 0.14   | 0.01   | 0.01   | 0.28   |     |  |
| Carbon Monoxide, g/km        | 2.08                                   | 0.08   | 0.06   | 1.43   | 1.76   | 0.11   | 0.04   | 1.92   |     |  |
| Oxides of Nitrogen, g/km     | 0.59                                   | 0.78   | 0.84   | 0.47   | 0.58   | 0.72   | 0.90   | 0.64   |     |  |
| <u>Particulates</u>          |                                        |        |        |        |        |        |        |        |     |  |
| Sulfate                      | 0.16                                   | 2.07   | 3.44   | 0.13   | 0.21   | 3.26   | 5.48   | 0.04   |     |  |
| Sulfate as % of TFS, %       | 6.06                                   | 97.18  | 179.17 | 3.03   | 8.14   | 155.24 | 285.42 | 0.84   |     |  |
| <u>Compound Group Totals</u> |                                        |        |        |        |        |        |        |        |     |  |
| Aldehydes & Ketones          | 0.2                                    | 0.6    | 0.0    | 1.9    | 0.1    | 0.0    | 1.9    | 2.0    |     |  |
| Individual Hydrocarbons      | 81.6                                   | 13.1   | 8.8    | 144.5  | 65.9   | 12.4   | 9.2    | 176.1  |     |  |
| Organic Sulfides             | --                                     | 0.00   | 0.00   | 0.03   | 0.04   | 0.04   | 0.06   | 0.00   |     |  |
| Organic Amines               | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.13   |     |  |
| <u>Other Compounds</u>       |                                        |        |        |        |        |        |        |        |     |  |
| Ammonia                      | 1.36                                   | 0.10   | 0.93   | 61.92  | 1.40   | 0.99   | 5.27   | 14.61  |     |  |
| Cyanide & Cyanogen           | 0.04                                   | --     | --     | 0.00   | 0.09   | 0.00   | 0.00   | 0.12   |     |  |
| DBPA                         | --                                     | --     | --     | --     | --     | --     | --     | --     |     |  |
| Hydrogen Sulfide             | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |     |  |
| Nickel Carbonyl              | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |     |  |
| Nitrous Oxide                | 20.14                                  | 13.61  | 9.69   | 21.08  | 23.24  | 12.31  | 9.42   | 18.02  |     |  |
| Sulfur Dioxide               | --                                     | --     | --     | --     | --     | --     | --     | --     |     |  |

Table B-1 (Cont'd). Car 21, Fuel No. 1, Initial Mileage

| Test Number, FVMEFT     | EMISSION RATE, MG/KM (Except as Noted) |       |      |        |       |       |      |        |
|-------------------------|----------------------------------------|-------|------|--------|-------|-------|------|--------|
|                         | FTP                                    | SET   | HFET | NYCC   | FTP   | SET   | HFET | NYCC   |
| Aldehydes and Ketones   |                                        |       |      |        |       |       |      |        |
| Formaldehyde            | 0.03                                   | 0.00  | 0.00 | 0.00   | 0.04  | 0.00  | 0.00 | 0.67   |
| Acetaldehyde            | 0.00                                   | 0.00  | 0.00 | 0.00   | 0.00  | 0.00  | 0.00 | 0.00   |
| Acetone                 | 0.00                                   | 0.00  | 0.00 | 0.00   | 0.00  | 0.00  | 1.91 | 0.00   |
| Isobutyraldehyde        | 0.06                                   | 0.00  | 0.00 | 0.00   | 0.00  | 0.00  | 0.00 | 0.00   |
| Methyl Ethyl Ketone     | 0.15                                   | 0.59  | 0.00 | 1.86   | 0.06  | 0.01  | 0.00 | 1.35   |
| Crotonaldehyde          | --                                     | --    | --   | --     | --    | --    | --   | --     |
| Hexanaldehyde           | 0.00                                   | 0.00  | 0.00 | 0.00   | 0.00  | 0.00  | 0.00 | 0.00   |
| Benzaldehyde            | --                                     | --    | --   | --     | --    | --    | --   | --     |
| Aldehydes and Ketones   | 0.2                                    | 0.6   | 0.0  | 1.9    | 0.1   | 0.0   | 1.9  | 2.0    |
| Total as % of THC,      | 0.1                                    | 3.0   | 0.0  | 1.0    | 0.1   | 0.0   | 19.0 | 0.7    |
| Individual Hydrocarbons |                                        |       |      |        |       |       |      |        |
| Methane                 | 35.79                                  | 11.92 | 8.31 | 121.23 | 27.75 | 11.26 | 8.61 | 147.58 |
| Ethylene                | 10.26                                  | 0.00  | 0.00 | 0.00   | 8.76  | 0.02  | 0.00 | 0.00   |
| Ethane                  | 3.89                                   | 1.08  | 0.46 | 16.95  | 4.14  | 1.14  | 0.58 | 21.64  |
| Acetylene               | 3.99                                   | 0.00  | 0.00 | 0.00   | 2.91  | 0.00  | 0.00 | 0.00   |
| Propane                 | 1.00                                   | 0.06  | 0.00 | 4.56   | 0.00  | 0.00  | 0.00 | 2.89   |
| Propylene               | 3.65                                   | 0.00  | 0.00 | 0.84   | 2.97  | 0.00  | 0.00 | 0.00   |
| Benzene                 | 9.13                                   | 0.00  | 0.00 | 0.87   | 7.85  | 0.00  | 0.00 | 3.97   |
| Toluene                 | 13.92                                  | 0.00  | 0.00 | 0.00   | 11.53 | 0.00  | 0.00 | 0.00   |
| Total Individual HC     | 81.6                                   | 13.1  | 8.8  | 144.5  | 65.9  | 12.4  | 9.2  | 176.1  |
| Total as % of THC,      | 48.0                                   | 65.3  | 44.0 | 76.1   | 47.1  | --    | 92.0 | 62.9   |
| Organic Sulfides        |                                        |       |      |        |       |       |      |        |
| Carbonyl Sulfide        | --                                     | 0.00  | 0.00 | 0.03   | 0.04  | 0.03  | 0.04 | 0.00   |
| Methyl Sulfide          | --                                     | 0.00  | 0.00 | 0.00   | 0.00  | 0.01  | 0.02 | 0.00   |
| Ethyl Sulfide           | --                                     | 0.00  | 0.00 | 0.00   | 0.00  | 0.00  | 0.00 | 0.00   |
| Methyl Disulfide        | --                                     | 0.00  | 0.00 | 0.00   | 0.00  | 0.00  | 0.00 | 0.00   |
| Organic Amines          |                                        |       |      |        |       |       |      |        |
| Monomethylamine         | 0.00                                   | 0.00  | 0.00 | 0.00   | 0.00  | 0.00  | 0.00 | 0.05   |
| Dimethylamine           | 0.00                                   | 0.00  | 0.00 | 0.00   | 0.00  | 0.00  | 0.00 | 0.08   |
| Trimethylamine          | 0.00                                   | 0.00  | 0.00 | 0.00   | 0.00  | 0.00  | 0.00 | 0.00   |
| Diethylamine            | 0.00                                   | 0.00  | 0.00 | 0.00   | 0.00  | 0.00  | 0.00 | 0.00   |
| Triethylamine           | 0.00                                   | 0.00  | 0.00 | 0.00   | 0.00  | 0.00  | 0.00 | 0.00   |

Table B-2. Car 21, Fuel No. 2, Initial Mileage

|                         |          | EMISSION RATE, MG/KM (Except as Noted) |        |        |        |        |        |        |        |
|-------------------------|----------|----------------------------------------|--------|--------|--------|--------|--------|--------|--------|
|                         |          | FTP                                    | SET    | HFET   | NYCC   | FTP    | SET    | HFET   | NYCC   |
| Test Number,            | PVNFST   | 210211                                 | 210212 | 210213 | 210214 | 210221 | 210222 | 210223 | 210224 |
| Barometer,              | mm Hg    | 744.7                                  | 744.5  | 744.5  | 744.5  | 745.2  | 745.2  | 748.0  | 745.5  |
| Humidity,               | g/kg     | 9.4                                    | 7.0    | 8.5    | 6.6    | 7.4    | 6.6    | 6.9    | 7.0    |
| Temperature,            | °C       | 24.4                                   | 25.6   | 25.0   | 25.0   | 24.4   | 25.0   | 25.6   | 25.6   |
| Total Fuel Sulfur,      | mg/km    | 26.59                                  | 21.31  | 19.40  | 50.04  | 26.16  | 21.08  | 18.79  | 41.56  |
| Carbon Dioxide,         | g/km     | 271.0                                  | 220.7  | 201.0  | 515.5  | 267.4  | 218.2  | 194.8  | 428.9  |
| Fuel Cons.,             | ℓ/100 km | 11.77                                  | 9.43   | 8.59   | 22.15  | 11.58  | 9.33   | 8.32   | 18.40  |
| Regulated Emissions     |          |                                        |        |        |        |        |        |        |        |
| Hydrocarbons (THC),     | g/km     | 0.18                                   | 0.01   | 0.01   | 0.36   | 0.15   | 0.02   | 0.01   | 0.11   |
| Carbon Monoxide,        | g/km     | 2.70                                   | 0.13   | 0.09   | 1.49   | 2.22   | 0.20   | 0.02   | 1.13   |
| Oxides of Nitrogen,     | g/km     | 0.59                                   | 0.75   | 0.96   | 0.70   | 0.56   | 0.72   | 0.81   | 0.61   |
| Particulates            |          |                                        |        |        |        |        |        |        |        |
| Sulfate                 |          | 0.11                                   | 11.87  | 17.55  | 0.19   | 0.43   | 13.17  | 31.97  | 0.91   |
| Sulfate as % of TFS,    | %        | 0.14                                   | 18.57  | 30.15  | 0.13   | 0.55   | 20.83  | 56.71  | 0.73   |
| Compound Group Totals   |          |                                        |        |        |        |        |        |        |        |
| Aldehydes & Ketones     |          | 3.0                                    | 0.3    | 0.7    | 5.8    | 1.1    | 0.4    | 0.3    | 1.7    |
| Individual Hydrocarbons |          | 84.3                                   | 16.9   | 8.7    | 119.7  | 79.6   | 17.0   | 8.6    | 97.4   |
| Organic Sulfides        |          | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Organic Amines          |          | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.03   | 0.00   | 0.02   | 0.18   |
| Other Compounds         |          |                                        |        |        |        |        |        |        |        |
| Ammonia                 |          | 11.14                                  | 1.11   | 1.78   | 27.13  | 0.71   | 0.24   | 4.36   | 8.64   |
| Cyanide & Cyanogen      |          | 0.31                                   | 0.00   | 0.02   | 1.67   | 0.32   | 0.00   | 0.00   | 0.00   |
| DMNA                    |          | --                                     | --     | --     | --     | --     | --     | --     | --     |
| Hydrogen Sulfide        |          | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Nickel Carbonyl         |          | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Nitrous Oxide           |          | 22.64                                  | 14.40  | 11.73  | 40.86  | 24.99  | 16.29  | 12.96  | 35.97  |
| Sulfur Dioxide          |          | --                                     | --     | --     | --     | --     | --     | --     | --     |

Table B-2 (Cont'd) - Car 21, Fuel No. 2, Initial Mileage

| Test Number,<br>Aldehydes and Ketones       | EMISSION RATE, MG/KM (Except as Noted) |            |            |            |            |            |
|---------------------------------------------|----------------------------------------|------------|------------|------------|------------|------------|
|                                             | FTP                                    | SET        | HFET       | NYCC       | FTP        | SET        |
| Formaldehyde                                | 0.06                                   | 0.12       | 0.25       | 3.28       | 0.32       | 0.20       |
| Acetaldehyde                                | 0.00                                   | 0.00       | 0.00       | 0.00       | 0.55       | 0.00       |
| Acetone                                     | 2.42                                   | 0.00       | 0.00       | 0.00       | 0.05       | 0.00       |
| Isobutyraldehyde                            | 0.00                                   | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       |
| Methyl Ethyl Ketone                         | 0.14                                   | 0.18       | 0.44       | 2.51       | 0.23       | 0.18       |
| Crotonaldehyde                              | --                                     | --         | --         | --         | --         | --         |
| Hexanaldehyde                               | 0.00                                   | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       |
| Benzaldehyde                                | --                                     | --         | --         | --         | --         | --         |
| Aldehydes and Ketones<br>Total as % of THC, | 3.0<br>1.7                             | 0.3<br>3.0 | 0.7<br>7.0 | 5.8<br>1.6 | 1.1<br>0.7 | 0.4<br>2.0 |
| Individual Hydrocarbons                     |                                        |            |            |            |            |            |
| Methane                                     | 40.04                                  | 15.27      | 8.28       | 101.32     | 36.00      | 15.83      |
| Ethylene                                    | 8.85                                   | 0.03       | 0.02       | 0.07       | 8.70       | 0.08       |
| Ethane                                      | 3.78                                   | 1.11       | 0.27       | 13.82      | 4.03       | 1.06       |
| Acetylene                                   | 3.93                                   | 0.00       | 0.00       | 0.00       | 3.70       | 0.00       |
| Propane                                     | 0.43                                   | 0.15       | 0.03       | 0.96       | 0.50       | 0.03       |
| Propylene                                   | 3.33                                   | 0.11       | 0.00       | 0.00       | 3.62       | 0.00       |
| Benzene                                     | 10.00                                  | 0.05       | 0.05       | 3.55       | 9.06       | 0.00       |
| Toluene                                     | 13.98                                  | 0.17       | 0.02       | 0.00       | 14.01      | 0.00       |
| Total Individual HC                         | 84.3                                   | 16.9       | 8.7        | 119.7      | 79.6       | 17.0       |
| Total as % of THC,                          | 46.8                                   | --         | 87.0       | 33.3       | 53.1       | 85.0       |
| Organic Sulfides                            |                                        |            |            |            |            |            |
| Carbonyl Sulfide                            | 0.00                                   | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       |
| Methyl Sulfide                              | 0.00                                   | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       |
| Ethyl Sulfide                               | 0.00                                   | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       |
| Methyl Disulfide                            | 0.00                                   | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       |
| Organic Amines                              |                                        |            |            |            |            |            |
| Monomethylamine                             | 0.00                                   | 0.00       | 0.00       | 0.00       | 0.02       | 0.00       |
| Dimethylamine                               | 0.00                                   | 0.00       | 0.00       | 0.00       | 0.01       | 0.00       |
| Trimethylamine                              | 0.00                                   | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       |
| Diethylamine                                | 0.00                                   | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       |
| Triethylamine                               | 0.00                                   | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       |

Table B-3. Car 21, Fuel No. 3, Initial Mileage  
Run 2

|                          | EMISSION RATE, MG/KM (Except as Noted) |        |        |        |        |        |        |        |
|--------------------------|----------------------------------------|--------|--------|--------|--------|--------|--------|--------|
|                          | FTP                                    | SET    | HFET   | NYCC   | FTP    | SET    | HFET   | NYCC   |
| Test Number,             | 210311                                 | 210312 | 210313 | 210314 | 210321 | 210322 | 210323 | 210324 |
| PVMPST                   |                                        |        |        |        |        |        |        |        |
| Barometer,               | 740.9                                  | 740.9  | 740.9  | 740.9  | 740.4  | 741.2  | 741.2  | 741.2  |
| mm Hg                    |                                        |        |        |        |        |        |        |        |
| Humidity,                | 12.1                                   | 10.7   | 12.1   | 11.1   | 12.2   | 11.7   | 10.6   | 11.4   |
| g/kg                     |                                        |        |        |        |        |        |        |        |
| Temperature,             | 25.0                                   | 26.7   | 26.7   | 27.2   | 26.7   | 27.8   | 26.7   | 26.7   |
| °C                       |                                        |        |        |        |        |        |        |        |
| Total Fuel Sulfur, mg/km | 23.73                                  | 20.22  | 18.37  | 46.37  | 24.45  | 20.30  | 18.30  | 42.51  |
| Carbon Dioxide, g/km     | 242.0                                  | 208.6  | 189.8  | 470.7  | 248.6  | 209.6  | 189.1  | 434.0  |
| Fuel Cons., g/100 km     | 10.47                                  | 8.92   | 8.11   | 20.46  | 10.79  | 8.96   | 8.07   | 18.76  |
| Regulated Emissions      |                                        |        |        |        |        |        |        |        |
| Hydrocarbons (THC), g/km | 0.14                                   | 0.03   | 0.01   | 0.61   | 0.17   | 0.02   | 0.01   | 0.35   |
| Carbon Monoxide, g/km    | 1.85                                   | 0.24   | 0.07   | 4.35   | 2.30   | 0.18   | 0.06   | 2.78   |
| Oxides of Nitrogen, g/km | 0.45                                   | 0.65   | 0.73   | 0.51   | 0.48   | 0.73   | 0.75   | 0.49   |
| Particulates             |                                        |        |        |        |        |        |        |        |
| Sulfate                  | 1.15                                   | 27.55  | 27.83  | 1.01   | 1.07   | 40.88  | 34.35  | 1.70   |
| Sulfate as % of TFS, %   | 1.62                                   | 45.42  | 50.50  | 0.73   | 1.46   | 67.13  | 62.57  | 1.33   |
| Compound Group Totals    |                                        |        |        |        |        |        |        |        |
| Aldehydes & Ketones      | 0.3                                    | 1.9    | 1.7    | 5.6    | 0.2    | 0.3    | 0.2    | 2.0    |
| Individual Hydrocarbons  | 78.6                                   | 28.9   | 9.7    | 362.2  | 84.0   | 22.7   | 9.6    | 234.9  |
| Organic Sulfides         | 0.09                                   | 0.19   | 0.04   | --     | --     | 0.20   | 0.04   | 0.00   |
| Organic Amines           | 0.00                                   | 0.01   | 0.00   | 0.29   | 0.00   | 0.00   | 0.00   | 0.00   |
| Other Compounds          |                                        |        |        |        |        |        |        |        |
| Ammonia                  | 2.14                                   | 1.05   | 1.02   | 16.54  | 1.85   | 0.97   | 2.86   | 5.73   |
| Cyanide & Cyanogen       | --                                     | 0.02   | 0.00   | 0.00   | 0.08   | 0.00   | 0.00   | 0.00   |
| DHNA                     | --                                     | --     | --     | --     | --     | --     | --     | --     |
| Hydrogen Sulfide         | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Nickel Carbonyl          | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Nitrous Oxide            | 15.85                                  | 9.28   | 7.16   | 29.38  | 19.91  | 9.43   | 7.10   | 25.20  |
| Sulfur Dioxide           | --                                     | --     | --     | --     | --     | --     | --     | --     |

Table B-3 (Cont'd). Car 21, Fuel No. 3, Initial Mileage

| Test Number, PVNFST                         | EMISSION RATE, MG/KM (Except as Noted) |            |             |            |            |            |
|---------------------------------------------|----------------------------------------|------------|-------------|------------|------------|------------|
|                                             | FTP                                    | SET        | HFET        | NVCC       | FTP        | SET        |
| Aldehydes and Ketones                       |                                        |            |             |            |            |            |
| Formaldehyde                                | 0.18                                   | 0.28       | 0.00        | 5.62       | 0.22       | 0.16       |
| Acetaldehyde                                | 0.00                                   | 0.74       | 1.66        | 0.00       | 0.00       | 0.00       |
| Acetone                                     | 0.02                                   | 0.00       | 0.00        | 0.00       | 0.00       | 0.00       |
| Isobutyraldehyde                            | 0.00                                   | 0.00       | 0.00        | 0.00       | 0.00       | 0.00       |
| Methyl Ethyl Ketone                         | 0.11                                   | 0.84       | 0.00        | 0.00       | 0.00       | 0.14       |
| Crotonaldehyde                              | --                                     | --         | --          | --         | --         | --         |
| Hexanaldehyde                               | 0.00                                   | 0.00       | 0.00        | 0.00       | 0.00       | 0.00       |
| Benzaldehyde                                | --                                     | --         | --          | --         | --         | --         |
| Aldehydes and Ketones<br>Total as % of THC, | 0.3<br>0.2                             | 1.9<br>6.3 | 1.7<br>17.0 | 5.6<br>0.9 | 0.2<br>0.1 | 0.3<br>1.5 |
| Individual Hydrocarbons                     |                                        |            |             |            |            |            |
| Methane                                     | 49.75                                  | 24.40      | 9.28        | 273.35     | 51.86      | 20.12      |
| Ethylene                                    | 9.55                                   | 1.82       | 0.00        | 25.96      | 12.02      | 0.89       |
| Ethane                                      | 5.36                                   | 2.02       | 0.38        | 28.43      | 6.01       | 1.70       |
| Acetylene                                   | 3.24                                   | 0.00       | 0.00        | 0.00       | 3.90       | 0.00       |
| Propane                                     | 1.24                                   | 0.53       | 0.00        | 14.10      | 0.24       | 0.00       |
| Propylene                                   | 3.95                                   | 0.00       | 0.00        | 5.49       | 4.56       | 0.00       |
| Benzene                                     | 3.71                                   | 0.17       | 0.00        | 14.82      | 3.74       | 0.01       |
| Toluene                                     | 1.79                                   | 0.00       | 0.00        | 0.00       | 1.67       | 0.00       |
| Total Individual HC                         | 78.6                                   | 28.9       | 9.7         | 362.2      | 84.0       | 22.7       |
| Total as % of THC,                          | 56.1                                   | 96.3       | 97.0        | 59.4       | 49.4       | --         |
| Organic Sulfides                            |                                        |            |             |            |            |            |
| Carbonyl Sulfide                            | 0.06                                   | 0.06       | 0.00        | --         | --         | 0.07       |
| Methyl Sulfide                              | 0.02                                   | 0.13       | 0.04        | --         | --         | 0.01       |
| Ethyl Sulfide                               | 0.01                                   | 0.00       | 0.00        | --         | --         | 0.00       |
| Methyl Disulfide                            | 0.00                                   | 0.00       | 0.00        | --         | --         | 0.00       |
| Organic Amines                              |                                        |            |             |            |            |            |
| Monomethylamine                             | 0.00                                   | 0.00       | 0.00        | 0.26       | 0.00       | 0.00       |
| Dimethylamine                               | 0.00                                   | 0.01       | 0.00        | 0.03       | 0.00       | 0.00       |
| Trimethylamine                              | 0.00                                   | 0.00       | 0.00        | 0.00       | 0.00       | 0.00       |
| Diethylamine                                | 0.00                                   | 0.00       | 0.00        | 0.00       | 0.00       | 0.00       |
| Triethylamine                               | 0.00                                   | 0.00       | 0.00        | 0.00       | 0.00       | 0.00       |



Table B-4. Car 21, Fuel No. 1 5000 Miles

|                              | EMISSION RATE, MG/KM (Except as Noted) |        |        |        |        |        |        |        |
|------------------------------|----------------------------------------|--------|--------|--------|--------|--------|--------|--------|
|                              | FTP                                    | SET    | HFET   | NYCC   | FTP    | SET    | HFET   | NYCC   |
| Test Number, PVHFST          | 211111                                 | 211112 | 211113 | 211114 | 211121 | 211122 | 211123 | 211124 |
| Barometer, mm Hg             | 738.6                                  | 738.9  | 738.9  | 738.9  | 734.3  | 734.6  | 734.3  | 734.3  |
| Humidity, g/kg               | 10.9                                   | 10.5   | 9.3    | 10.2   | 11.3   | 9.8    | 10.1   | 9.8    |
| Temperature, °C              | 22.8                                   | 23.9   | 25.0   | 24.4   | 23.9   | 25.6   | 25.0   | 23.9   |
| Total Fuel Sulfur, mg/km     | 0.83                                   | 0.65   | 0.61   | 1.52   | 0.84   | 0.66   | 0.63   | 1.54   |
| Carbon Dioxide, g/km         | 254.7                                  | 202.1  | 190.6  | 469.5  | 254.9  | 204.7  | 197.0  | 474.5  |
| Fuel Cons., l/100 km         | 11.07                                  | 8.64   | 8.14   | 20.15  | 11.11  | 8.75   | 8.42   | 20.47  |
| <b>Regulated Emissions</b>   |                                        |        |        |        |        |        |        |        |
| Hydrocarbons (THC), g/km     | 0.16                                   | 0.01   | 0.01   | 0.15   | 0.19   | 0.02   | 0.01   | 0.33   |
| Carbon Monoxide, g/km        | 2.59                                   | 0.21   | 0.04   | 1.33   | 3.11   | 0.15   | 0.06   | 2.51   |
| Oxides of Nitrogen, g/km     | 0.42                                   | 0.56   | 0.60   | 0.55   | 0.43   | 0.57   | 0.65   | 0.49   |
| <b>Particulates</b>          |                                        |        |        |        |        |        |        |        |
| Sulfate                      | 0.16                                   | 0.39   | 0.58   | 0.37   | 0.12   | 0.75   | --     | 0.60   |
| Sulfate as % of TFS, %       | 6.43                                   | 20.00  | 31.69  | 8.11   | 4.76   | 37.88  | --     | 12.99  |
| <b>Compound Group Totals</b> |                                        |        |        |        |        |        |        |        |
| Aldehydes & Ketones          | 1.6                                    | 2.1    | 1.3    | 10.7   | 2.9    | 3.1    | 2.2    | 12.1   |
| Individual Hydrocarbons      | 92.5                                   | 17.8   | 11.2   | 112.5  | 109.3  | 18.5   | 8.2    | 229.3  |
| Organic Sulfides             | --                                     | --     | --     | --     | 0.12   | 0.01   | 0.02   | 0.34   |
| Organic Amines               | 0.00                                   | 0.04   | 0.01   | 0.00   | 0.02   | 0.05   | 0.01   | 0.01   |
| <b>Other Compounds</b>       |                                        |        |        |        |        |        |        |        |
| Ammonia                      | 6.12                                   | 1.87   | 1.82   | 26.21  | 4.68   | 2.45   | 2.85   | 17.84  |
| Cyanide & Cyanogen           | 1.12                                   | 0.03   | 0.11   | 5.58   | 1.51   | 0.21   | 0.00   | 0.00   |
| DMNA                         | --                                     | --     | --     | --     | --     | --     | --     | --     |
| Hydrogen Sulfide             | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Nickel Carbonyl              | 0.00                                   | 0.00   | 0.00   | 0.00   | --     | --     | --     | --     |
| Nitrous Oxide                | 20.35                                  | 9.26   | 6.79   | 31.30  | 19.05  | 10.21  | 4.14   | 31.97  |
| Sulfur Dioxide               | --                                     | --     | --     | --     | --     | --     | --     | --     |

Table B-4 (Cont'd). Car 21, Fuel No. 1, 5000 Miles

|                         |        | EMISSION RATE, MG/KM (Excerpt as Noted) |        |        |        |        |        |        |        |
|-------------------------|--------|-----------------------------------------|--------|--------|--------|--------|--------|--------|--------|
|                         |        | FTP                                     |        | SET    |        | HFET   |        | NVCC   |        |
| Test Number,            | PUMPST | 211111                                  | 211112 | 211113 | 211114 | 211121 | 211122 | 211123 | 211124 |
| Aldehydes and Ketones   |        |                                         |        |        |        |        |        |        |        |
| Formaldehyde            |        | 0.85                                    | 1.25   | 1.04   | 4.70   | 0.80   | 1.66   | 1.52   | 3.35   |
| Acetaldehyde            |        | 0.11                                    | 0.27   | 0.10   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Acetone                 |        | 0.61                                    | 0.55   | 0.17   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Isobutyraldehyde        |        | 0.00                                    | 0.00   | 0.00   | 5.16   | 2.08   | 1.43   | 0.71   | 8.71   |
| Methyl Ethyl Ketone     |        | 0.00                                    | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Crotonaldehyde          |        | --                                      | --     | --     | --     | --     | --     | --     | --     |
| Hexanaldehyde           |        | 0.00                                    | 0.07   | 0.00   | 0.81   | 0.00   | 0.00   | 0.00   | 0.00   |
| Benzaldehyde            |        | --                                      | --     | --     | --     | --     | --     | --     | --     |
| Aldehydes and Ketones   |        | 1.6                                     | 2.1    | 1.3    | 10.7   | 2.9    | 3.1    | 2.2    | 12.1   |
| Total as % of THC,      |        | 1.0                                     | 21.0   | 13.0   | 7.1    | 1.5    | 15.5   | 22.0   | 3.7    |
| Individual Hydrocarbons |        |                                         |        |        |        |        |        |        |        |
| Methane                 |        | 44.08                                   | 16.21  | 6.71   | 88.65  | 53.05  | 15.95  | 7.42   | 167.73 |
| Ethylene                |        | 9.95                                    | 0.07   | 0.00   | 0.04   | 13.24  | 0.35   | 0.00   | 8.55   |
| Ethane                  |        | 5.48                                    | 1.52   | 0.63   | 14.65  | 6.23   | 1.51   | 0.54   | 26.84  |
| Acetylene               |        | 3.78                                    | 0.00   | 0.00   | 0.00   | 4.39   | 0.00   | 0.00   | 0.00   |
| Propane                 |        | 3.04                                    | 0.00   | 3.86   | 5.55   | 2.15   | 0.26   | 0.19   | 7.26   |
| Propylene               |        | 3.21                                    | 0.00   | 0.00   | 0.00   | 3.97   | 0.00   | 0.00   | 0.82   |
| Benzene                 |        | 10.50                                   | 0.00   | 0.00   | 3.64   | 11.54  | 0.28   | 0.00   | 13.09  |
| Toluene                 |        | 12.47                                   | 0.00   | 0.00   | 0.00   | 14.71  | 0.14   | 0.00   | 5.00   |
| Total Individual HC     |        | 92.5                                    | 17.8   | 11.2   | 112.5  | 109.3  | 18.5   | 8.2    | 229.3  |
| Total as % of THC,      |        | 57.8                                    | --     | --     | 75.0   | 57.5   | 92.5   | 82.0   | 69.5   |
| Organic Sulfides        |        |                                         |        |        |        |        |        |        |        |
| Carbonyl Sulfide        |        | --                                      | --     | --     | --     | 0.08   | 0.01   | 0.02   | 0.28   |
| Methyl Sulfide          |        | --                                      | --     | --     | --     | 0.01   | 0.00   | 0.00   | 0.06   |
| Ethyl Sulfide           |        | --                                      | --     | --     | --     | 0.02   | 0.00   | 0.00   | 0.00   |
| Methyl Disulfide        |        | --                                      | --     | --     | --     | 0.01   | 0.00   | 0.00   | 0.00   |
| Organic Amines          |        |                                         |        |        |        |        |        |        |        |
| Monomethylamine         |        | 0.00                                    | 0.02   | 0.01   | 0.00   | 0.00   | 0.01   | 0.00   | 0.00   |
| Dimethylamine           |        | 0.00                                    | 0.02   | 0.00   | 0.00   | 0.01   | 0.01   | 0.00   | 0.00   |
| Trimethylamine          |        | 0.00                                    | 0.00   | 0.00   | 0.00   | 0.01   | 0.03   | 0.01   | 0.01   |
| Diethylamine            |        | 0.00                                    | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Triethylamine           |        | 0.00                                    | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |

Table B-5. Car 21, Fuel No. 2, 5000 Miles

| EMISSION RATE, MG/KM (Except as Noted) |  |     |  |     |  |      |  |      |  |
|----------------------------------------|--|-----|--|-----|--|------|--|------|--|
|                                        |  | FTP |  | SET |  | HFET |  | NYCC |  |
|                                        |  |     |  |     |  |      |  |      |  |
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Table B-5 (Cont'd). Car 21, Fuel No. 2, 5000 Miles

| EMISSION RATE, MG/KM (Except as Noted) |        |        |        |        |        |        |        |      |        |
|----------------------------------------|--------|--------|--------|--------|--------|--------|--------|------|--------|
| Test Number,<br>Aldehydes and Ketones  | PVNFST | FTP    |        | SET    | HFET   | NYCC   |        | NYCC |        |
|                                        |        | 211211 | 211212 | 211213 | 211214 | 211221 | 211222 |      | 211223 |
| Formaldehyde                           |        | 0.86   | 0.52   | 1.00   | 1.62   | 1.00   | 0.78   | 1.54 | 3.15   |
| Acetaldehyde                           |        | 0.00   | 0.00   | 0.00   | 0.12   | 0.49   | 0.23   | 0.05 | 0.43   |
| Acetone                                |        | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00 | 0.00   |
| Isobutyraldehyde                       |        | 0.10   | 0.00   | 0.18   | 5.66   | 0.81   | 0.00   | 1.32 | 14.54  |
| Methyl Ethyl Ketone                    |        | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00 | 0.00   |
| Crotonaldehyde                         |        | --     | --     | --     | --     | --     | --     | --   | --     |
| Hexanaldehyde                          |        | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00 | 0.00   |
| Benzaldehyde                           |        | --     | --     | --     | --     | --     | --     | --   | --     |
| Aldehydes and Ketones                  |        | 1.0    | 0.5    | 1.2    | 7.4    | 2.3    | 1.0    | 2.9  | 18.1   |
| Total as % of THC,                     |        | 0.5    | 2.5    | 12.0   | 7.4    | 1.1    | 10.0   | 29.0 | 13.9   |
| Individual Hydrocarbons                |        |        |        |        |        |        |        |      |        |
| Methane                                |        | 49.20  | 14.88  | 7.18   | 60.20  | 47.60  | 21.46  | 9.50 | 94.51  |
| Ethylene                               |        | 9.56   | 0.01   | 0.00   | 0.29   | 11.26  | 0.00   | 0.00 | 0.00   |
| Ethane                                 |        | 5.80   | 1.36   | 0.46   | 11.21  | 4.74   | 1.23   | 0.33 | 12.64  |
| Acetylene                              |        | 4.24   | 0.00   | 0.00   | 0.00   | 4.80   | 0.00   | 0.00 | 0.00   |
| Propane                                |        | 0.87   | 0.36   | 0.09   | 0.57   | 0.27   | 0.08   | 1.23 | 6.00   |
| Propylene                              |        | 3.31   | 0.00   | 0.00   | 0.00   | 3.87   | 0.09   | 0.08 | 0.24   |
| Benzene                                |        | 12.20  | 0.44   | 0.05   | 0.80   | 12.83  | 0.13   | 0.00 | 2.39   |
| Toluene                                |        | 16.97  | 0.00   | 0.00   | 0.00   | 18.83  | 0.12   | 0.00 | 0.00   |
| Total Individual HC                    |        | 102.2  | 17.1   | 7.8    | 73.1   | 104.2  | 23.1   | 11.1 | 115.8  |
| Total as % of THC,                     |        | 53.8   | 85.5   | 78.0   | 73.1   | 49.6   | --     | --   | 89.1   |
| Organic Sulfides                       |        |        |        |        |        |        |        |      |        |
| Carbonyl Sulfide                       |        | 0.39   | 0.26   | 0.31   | 3.01   | 0.02   | 0.02   | 0.03 | 0.00   |
| Methyl Sulfide                         |        | 0.13   | 0.12   | 0.13   | 1.33   | 0.01   | 0.01   | 0.01 | 0.00   |
| Ethyl Sulfide                          |        | 0.01   | 0.00   | 0.00   | 0.00   | 0.14   | 0.00   | 0.00 | 0.00   |
| Methyl Disulfide                       |        | 0.00   | 0.00   | 0.00   | 0.00   | 0.04   | 0.00   | 0.01 | 0.00   |
| Organic Amines                         |        |        |        |        |        |        |        |      |        |
| Monomethylamine                        |        | 0.00   | 0.01   | 0.00   | 0.00   | 0.01   | 0.00   | 0.00 | 0.06   |
| Monomethylamine                        |        | 0.00   | 0.00   | 0.00   | 0.06   | 0.00   | 0.00   | 0.00 | 0.01   |
| Trimethylamine                         |        | 0.00   | 0.01   | 0.00   | 0.05   | 0.00   | 0.00   | 0.00 | 0.00   |
| Diethylamine                           |        | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00 | 0.00   |
| Triethylamine                          |        | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00 | 0.00   |

Table B-6. Car 21, Fuel No. 3, 5000 Miles

|                              | EMISSION RATE, MG/KM (Except as Noted) |        |        |        |        |        |        |        |
|------------------------------|----------------------------------------|--------|--------|--------|--------|--------|--------|--------|
|                              | FTP                                    | SET    | HFET   | NYCC   | FTP    | SET    | HFET   | NYCC   |
| Test Number, PMFST           | 211311                                 | 211312 | 211313 | 211314 | 211321 | 211322 | 211323 | 211324 |
| Barometer, mm Hg             | 738.4                                  | 736.3  | 736.1  | 738.4  | 740.9  | 740.9  | 738.9  | 738.9  |
| Humidity, g/kg               | 12.4                                   | 10.7   | 9.8    | 12.2   | 12.4   | 11.6   | 9.0    | 11.7   |
| Temperature, °C              | 24.4                                   | 25.0   | 25.6   | 23.3   | 24.4   | 24.4   | 25.6   | 26.1   |
| Total Fuel Sulfur, mg/km     | 25.70                                  | 20.25  | 18.73  | 47.31  | 25.92  | 20.13  | 18.78  | 48.08  |
| Carbon Dioxide, g/km         | 260.5                                  | 209.0  | 193.6  | 475.0  | 261.8  | 207.8  | 194.1  | 486.0  |
| Fuel Cons., l/100 km         | 11.34                                  | 8.93   | 8.27   | 20.88  | 11.44  | 8.88   | 8.29   | 21.22  |
| <u>Regulated Emissions</u>   |                                        |        |        |        |        |        |        |        |
| Hydrocarbons (THC), g/km     | 0.21                                   | 0.02   | 0.01   | 1.05   | 0.25   | 0.03   | 0.01   | 0.74   |
| Carbon Monoxide, g/km        | 2.88                                   | 0.19   | 0.05   | 6.86   | 3.41   | 0.12   | 0.04   | 5.58   |
| Oxides of Nitrogen, g/km     | 0.40                                   | 0.49   | 0.48   | 0.54   | 0.39   | 0.58   | 0.54   | 0.53   |
| <u>Particulates</u>          |                                        |        |        |        |        |        |        |        |
| Sulfate                      | 0.54                                   | 22.71  | 26.92  | 1.62   | 1.83   | 23.15  | 15.77  | 1.33   |
| Sulfate as % of TFS, %       | 0.70                                   | 37.38  | 47.92  | 1.14   | 2.35   | 38.33  | 27.99  | 0.92   |
| <u>Compound Group Totals</u> |                                        |        |        |        |        |        |        |        |
| Aldehydes & Ketones          | 2.6                                    | 2.8    | 1.6    | 9.9    | 3.5    | 2.6    | 3.5    | 1.2    |
| Individual Hydrocarbons      | 130.8                                  | 24.6   | 12.0   | 559.4  | 147.6  | 24.8   | 12.5   | 434.0  |
| Organic Sulfides             | 0.11                                   | 0.05   | 0.03   | 0.01   | 0.05   | 0.03   | 0.00   | 0.00   |
| Organic Amines               | 0.01                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.01   | 0.03   |
| <u>Other Compounds</u>       |                                        |        |        |        |        |        |        |        |
| Ammonia                      | 5.08                                   | 5.97   | 2.82   | 37.59  | --     | 2.01   | 2.54   | 21.72  |
| Cyanide & Cyanogen           | 0.02                                   | 0.00   | 0.02   | 0.89   | 0.10   | 0.13   | 0.25   | 3.57   |
| DMNA                         | --                                     | --     | --     | --     | --     | --     | --     | --     |
| Hydrogen Sulfide             | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Nickel Carbonyl              | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Nitrous Oxide                | 21.28                                  | 9.42   | 4.50   | 31.60  | 18.20  | 9.37   | 4.64   | 33.04  |
| Sulfur Dioxide               | --                                     | --     | --     | --     | --     | --     | --     | --     |

Table B-6 (Cont'd). Car 21, Fuel No. 3, 5000 Miles

|                         |  | EMISSION RATE, MG/KM (Except as Noted) |        |        |        |        |        |        |        |
|-------------------------|--|----------------------------------------|--------|--------|--------|--------|--------|--------|--------|
|                         |  | FTP                                    |        | SET    |        | HFET   |        | NYCC   |        |
| Test Number, PMFST      |  | 211311                                 | 211312 | 211313 | 211314 | 211321 | 211322 | 211323 | 211324 |
| Aldehydes and Ketones   |  |                                        |        |        |        |        |        |        |        |
| Formaldehyde            |  | 1.92                                   | 1.97   | 1.02   | 1.99   | 2.23   | 2.28   | 2.74   | 0.00   |
| Acetaldehyde            |  | 0.05                                   | 0.10   | 0.05   | 0.42   | 0.17   | 0.16   | 0.41   | 0.00   |
| Acetone                 |  | 0.00                                   | 0.58   | 0.24   | 2.07   | 0.05   | 0.05   | 0.07   | 0.00   |
| Isobutyraldehyde        |  | 0.67                                   | 0.13   | 0.24   | 5.38   | 1.02   | 0.14   | 0.32   | 1.24   |
| Methyl Ethyl Ketone     |  | 0.00                                   | 0.06   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Crotonaldehyde          |  | --                                     | --     | --     | --     | --     | --     | --     | --     |
| Hexanaldehyde           |  | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Benzaldehyde            |  | --                                     | --     | --     | --     | --     | --     | --     | --     |
| Aldehydes and Ketones   |  | 2.6                                    | 2.8    | 1.6    | 9.9    | 3.5    | 2.6    | 3.5    | 1.2    |
| Total as % of THC,      |  | 1.2                                    | 14.0   | 16.0   | 0.9    | 1.4    | 8.7    | 35.0   | 0.2    |
| Individual Hydrocarbons |  |                                        |        |        |        |        |        |        |        |
| Methane                 |  | 89.95                                  | 22.15  | 10.92  | 367.77 | 95.65  | 22.56  | 11.44  | 292.48 |
| Ethylene                |  | 14.17                                  | 0.39   | 0.17   | 97.16  | 18.36  | 0.00   | 0.00   | 59.15  |
| Ethane                  |  | 9.88                                   | 2.09   | 0.73   | 43.07  | 11.32  | 2.13   | 0.99   | 35.73  |
| Acetylene               |  | 4.22                                   | 0.00   | 0.00   | 0.00   | 4.21   | 0.00   | 0.00   | 0.00   |
| Propane                 |  | 1.72                                   | 0.00   | 0.06   | 11.53  | 2.64   | 0.00   | 0.00   | 11.06  |
| Propylene               |  | 4.02                                   | 0.00   | 0.08   | 15.38  | 5.66   | 0.00   | 0.04   | 12.77  |
| Benzene                 |  | 4.38                                   | 0.00   | 0.00   | 23.63  | 5.71   | 0.06   | 0.00   | 17.55  |
| Toluene                 |  | 2.44                                   | 0.00   | 0.00   | 0.84   | 4.07   | 0.00   | 0.00   | 5.21   |
| Total Individual HC     |  | 130.8                                  | 24.6   | 12.0   | 559.4  | 147.6  | 24.8   | 12.5   | 434.0  |
| Total as % of THC,      |  | 62.3                                   | --     | --     | 53.3   | 59.0   | 82.7   | --     | 58.6   |
| Organic Sulfides        |  |                                        |        |        |        |        |        |        |        |
| Carbonyl Sulfide        |  | 0.06                                   | 0.02   | 0.03   | 0.01   | 0.02   | 0.01   | 0.00   | 0.00   |
| Methyl Sulfide          |  | 0.02                                   | 0.03   | 0.00   | 0.00   | 0.01   | 0.02   | 0.00   | 0.00   |
| Ethyl Sulfide           |  | 0.03                                   | 0.00   | 0.00   | 0.00   | 0.02   | 0.00   | 0.00   | 0.00   |
| Methyl Disulfide        |  | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Organic Amines          |  |                                        |        |        |        |        |        |        |        |
| Monomethylamine         |  | 0.01                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.01   |
| Dimethylamine           |  | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.01   | 0.00   |
| Trimethylamine          |  | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Diethylamine            |  | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Triethylamine           |  | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |

Table B-7. Car 21, Fuel No. 1, 10,000 Miles

|                          | EMISSION RATE, MG/KM (Except as Noted) |        |        |        |        |        |        |        |
|--------------------------|----------------------------------------|--------|--------|--------|--------|--------|--------|--------|
|                          | FTP                                    | SET    | HFET   | NVCC   | FTP    | SET    | HFET   | NVCC   |
| Test Number, 212111      | 212111                                 | 212112 | 212113 | 212114 | 212121 | 212122 | 212123 | 212124 |
| Barometer, mm Hg         | 743.2                                  | 743.2  | 743.2  | 743.2  | 739.6  | 742.2  | 742.2  | 742.2  |
| Humidity, g/kg           | 12.3                                   | 12.3   | 12.3   | 11.3   | 12.1   | 11.9   | 14.4   | 12.3   |
| Temperature, °C          | 22.6                                   | 22.6   | 22.6   | 23.3   | 23.3   | 25.6   | 23.3   | 24.4   |
| Total Fuel Sulfur, mg/km | 0.86                                   | 0.70   | 0.62   | 1.62   | 0.88   | 0.70   | 0.63   | 1.61   |
| Carbon Dioxide, g/km     | 270.3                                  | 216.7  | 193.1  | 501.0  | 267.5  | 217.5  | 194.8  | 500.9  |
| Fuel Cons., l/100 km     | 11.72                                  | 9.27   | 8.25   | 21.45  | 11.66  | 9.31   | 8.32   | 21.45  |
| Regulated Emissions      |                                        |        |        |        |        |        |        |        |
| Hydrocarbons (THC), g/km | 0.24                                   | 0.05   | 0.02   | 0.26   | 0.28   | 0.05   | 0.03   | 0.22   |
| Carbon Monoxide, g/km    | 2.19                                   | 0.14   | 0.07   | 0.54   | 3.09   | 0.25   | 0.03   | 0.58   |
| Oxides of Nitrogen, g/km | 0.52                                   | 0.69   | 0.76   | 0.46   | 0.45   | 0.63   | 0.68   | 0.68   |
| Particulates             |                                        |        |        |        |        |        |        |        |
| Sulfate                  | 1.21                                   | 6.30   | 10.39  | 0.82   | 0.61   | 12.41  | 25.90  | 0.78   |
| Sulfate as % of TFS, %   | 45.81                                  | --     | --     | 16.87  | 23.11  | --     | --     | 16.15  |
| Compound Group Totals    |                                        |        |        |        |        |        |        |        |
| Aldehydes & Ketones      | 1.1                                    | 1.4    | 5.0    | 16.6   | 1.8    | 1.1    | 3.9    | 44.5   |
| Individual Hydrocarbons  | 96.6                                   | 22.2   | 13.9   | 86.4   | 126.4  | 26.0   | 13.7   | 87.7   |
| Organic Sulfides         | 0.48                                   | 0.27   | 0.14   | 2.04   | 0.08   | 0.23   | 0.02   | 0.39   |
| Organic Amines           | 0.01                                   | 0.01   | 0.02   | 0.04   | 0.02   | 0.01   | 0.00   | 0.01   |
| Other Compounds          |                                        |        |        |        |        |        |        |        |
| Ammonia                  | 3.12                                   | 0.92   | 2.08   | 13.61  | 1.05   | 0.44   | 2.63   | 16.04  |
| Cyanide & Cyanogen       | 1.09                                   | 0.17   | 0.00   | 1.63   | 2.63   | 0.10   | 0.00   | 2.56   |
| DMCA                     | --                                     | --     | --     | --     | --     | --     | --     | --     |
| Hydrogen Sulfide         | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Nickel Carbonyl          | --                                     | --     | --     | --     | 0.00   | 0.00   | 0.00   | 0.00   |
| Nitrous Oxide            | 22.38                                  | 12.35  | 9.46   | 74.64  | 22.86  | 12.42  | 6.58   | 72.66  |
| Sulfur Dioxide           | --                                     | --     | --     | --     | --     | --     | --     | --     |



Table B-7 (Cont'd). Car 21, Fuel No. 1, 10,000 Miles

| EMISSION RATE, MG/KM (Except as Noted) |       |        |       |        |       |        |       |        |       |
|----------------------------------------|-------|--------|-------|--------|-------|--------|-------|--------|-------|
|                                        |       | FTP    |       | SET    |       | HFET   |       | NYCC   |       |
|                                        |       | 212111 |       | 212112 |       | 212113 |       | 212114 |       |
|                                        |       | 212121 |       | 212122 |       | 212123 |       | 212124 |       |
| Test Number, Aldehydes and Ketones     | PMPST | 0.63   | 1.05  | 1.02   | 6.72  | 0.80   | 1.06  | 0.98   | 7.33  |
| Formaldehyde                           |       | 0.01   | 0.00  | 0.00   | 0.37  | 0.00   | 0.00  | 0.00   | 0.00  |
| Acetaldehyde                           |       | 0.00   | 0.00  | 0.00   | 0.00  | 0.00   | 0.00  | 0.00   | 0.00  |
| Acetone                                |       | 0.49   | 0.33  | 0.00   | 9.67  | 1.01   | 0.00  | 2.91   | --    |
| Isobutyraldehyde                       |       | 0.00   | 0.00  | 0.00   | 0.00  | 0.00   | 0.00  | 0.00   | 0.00  |
| Methyl Ethyl Ketone                    |       | 0.00   | 0.00  | 0.00   | 0.00  | 0.00   | 0.00  | 0.00   | 0.00  |
| Crotonaldehyde                         |       | 0.00   | 0.00  | 0.00   | 0.00  | 0.00   | 0.00  | 0.00   | 0.00  |
| Hexanaldehyde                          |       |        |       |        |       |        |       |        |       |
| Benzaldehyde                           |       |        |       |        |       |        |       |        |       |
| Aldehydes and Ketones                  |       | 1.1    | 1.4   | 1.0    | 16.8  | 1.8    | 1.1   | 3.9    | 7.33  |
| Total as % of THC,                     | %     | 0.5    | 2.8   | 5.0    | 6.5   | 0.6    | 2.2   | 13.0   | 3.3   |
| Individual Hydrocarbons                |       |        |       |        |       |        |       |        |       |
| Methane                                |       | 46.60  | 19.27 | 12.36  | 58.69 | 51.50  | 22.49 | 12.13  | 61.07 |
| Ethylene                               |       | 9.51   | 0.17  | 0.04   | 4.37  | 14.32  | 0.45  | 0.04   | 4.03  |
| Ethane                                 |       | 5.35   | 2.08  | 1.12   | 16.41 | 8.27   | 2.51  | 1.21   | 15.56 |
| Acetylene                              |       | 4.32   | 0.00  | 0.00   | 0.00  | 5.93   | 0.00  | 0.00   | 0.00  |
| Propane                                |       | 0.24   | 0.00  | 0.00   | 0.29  | 0.28   | 0.00  | 0.00   | 0.00  |
| Propylene                              |       | 3.38   | 0.00  | 0.00   | 0.55  | 5.64   | 0.00  | 0.00   | 0.00  |
| Benzene                                |       | 12.64  | 0.68  | 0.38   | 6.12  | 17.63  | 0.52  | 0.30   | 6.25  |
| Toluene                                |       | 16.75  | 0.00  | 0.00   | 0.00  | 22.87  | 0.00  | 0.00   | 0.76  |
| Total Individual HC                    |       | 98.8   | 22.2  | 13.9   | 86.4  | 126.4  | 26.0  | 13.7   | 87.7  |
| Total as % of THC,                     | %     | 41.2   | 44.4  | 69.5   | 33.2  | 45.1   | 52.0  | 45.7   | 39.9  |
| Organic Sulfides                       |       |        |       |        |       |        |       |        |       |
| Carbonyl Sulfide                       |       | 0.41   | 0.12  | 0.08   | 1.76  | 0.03   | 0.19  | 0.00   | 0.19  |
| Methyl Sulfide                         |       | 0.06   | 0.14  | 0.04   | 0.28  | 0.00   | 0.03  | 0.02   | 0.00  |
| Ethyl Sulfide                          |       | 0.00   | 0.00  | 0.00   | 0.00  | 0.04   | 0.00  | 0.00   | 0.00  |
| Methyl Disulfide                       |       | 0.01   | 0.01  | 0.02   | 0.00  | 0.01   | 0.01  | 0.00   | 0.00  |
| Organic Amines                         |       |        |       |        |       |        |       |        |       |
| Monomethylamine                        |       | 0.00   | 0.00  | 0.00   | 0.00  | 0.01   | 0.01  | 0.00   | 0.00  |
| Monomethylamine                        |       | 0.01   | 0.01  | 0.02   | 0.04  | 0.00   | 0.00  | 0.00   | 0.00  |
| Trimethylamine                         |       | 0.00   | 0.00  | 0.00   | 0.00  | 0.00   | 0.00  | 0.00   | 0.00  |
| Trimethylamine                         |       | 0.00   | 0.00  | 0.00   | 0.00  | 0.00   | 0.00  | 0.00   | 0.00  |
| Diethylamine                           |       | 0.00   | 0.00  | 0.00   | 0.00  | 0.00   | 0.00  | 0.00   | 0.00  |
| Triethylamine                          |       | 0.00   | 0.00  | 0.00   | 0.00  | 0.00   | 0.00  | 0.00   | 0.00  |

Table B-8. Car 21, Fuel No. 2, 10,000 Miles

|                              |        | EMISSION RATE, MG/KM (Except as Noted) |        |        |        |        |        |        |        |
|------------------------------|--------|----------------------------------------|--------|--------|--------|--------|--------|--------|--------|
|                              |        | FTP                                    | SET    | HFET   | HWCC   | FTP    | SET    | HFET   | HWCC   |
| Test Number,                 | PVW/ST | 212211                                 | 212212 | 212213 | 212214 | 212221 | 212222 | 212223 | 212224 |
| Barometer,                   | mm Hg  | 743.2                                  | 743.7  | 743.7  | 743.7  | 730.9  | 730.9  | 730.9  | 730.9  |
| Humidity,                    | g/kg   | 12.5                                   | 11.8   | 11.6   | 11.6   | 13.4   | 12.2   | 11.2   | 11.2   |
| Temperature,                 | °C     | 22.2                                   | 23.9   | 23.9   | 24.4   | 23.9   | 25.0   | 25.0   | 25.6   |
| Total Fuel Sulfur, mg/km     |        | 26.45                                  | 21.48  | 19.03  | 49.78  | 25.78  | 20.70  | 10.15  | 47.60  |
| Carbon Dioxide, g/km         |        | 269.8                                  | 222.4  | 197.2  | 515.0  | 262.2  | 214.4  | 108.2  | 492.3  |
| Fuel Cons., l/100 km         |        | 11.71                                  | 9.51   | 8.42   | 22.04  | 11.41  | 9.16   | 6.04   | 21.07  |
| <u>Regulated Emissions</u>   |        |                                        |        |        |        |        |        |        |        |
| Hydrocarbons (THC), g/km     |        | 0.25                                   | 0.05   | 0.03   | 0.25   | 0.25   | 0.05   | 0.02   | 0.21   |
| Carbon Monoxide, g/km        |        | 2.39                                   | 0.15   | 0.02   | 0.30   | 2.81   | 0.10   | 0.03   | 0.48   |
| Oxides of Nitrogen, g/km     |        | 0.54                                   | 0.74   | 0.73   | 0.72   | 0.48   | 0.73   | 0.72   | 0.72   |
| <u>Particulates</u>          |        |                                        |        |        |        |        |        |        |        |
| Sulfate                      |        | 0.27                                   | 19.15  | 34.96  | 0.78   | 1.23   | 32.85  | 40.88  | 0.83   |
| Sulfate as % of TFS, %       |        | 0.34                                   | 29.72  | 61.24  | 0.52   | 1.59   | 52.90  | 74.04  | 0.58   |
| <u>Compound Group Totals</u> |        |                                        |        |        |        |        |        |        |        |
| Aldehydes & Ketones          |        | 1.0                                    | 1.7    | 1.7    | 3.2    | 3.5    | 1.8    | 1.8    | 14.7   |
| Individual Hydrocarbons      |        | 93.1                                   | 25.4   | 13.6   | 108.0  | 115.5  | 27.4   | 15.5   | 99.0   |
| Organic Sulfides             |        | 0.02                                   | 0.24   | 0.03   | 1.13   | --     | 0.44   | 0.20   | 1.18   |
| Organic Amines               |        | 0.00                                   | 0.00   | 0.00   | 0.08   | --     | 0.04   | 0.05   | 0.28   |
| <u>Other Compounds</u>       |        |                                        |        |        |        |        |        |        |        |
| Ammonia                      |        | 2.30                                   | 1.77   | 1.07   | 13.88  | 1.25   | 0.64   | 1.79   | 5.62   |
| Cyanide & Cyanogen           |        | 0.49                                   | 0.46   | 0.28   | 2.26   | 0.57   | 0.35   | 0.39   | 0.69   |
| DMNA                         |        | --                                     | --     | --     | --     | --     | --     | --     | --     |
| Hydrogen Sulfide             |        | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Nickel Carbonyl              |        | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Nitrous Oxide                |        | 28.34                                  | 12.52  | 8.55   | 49.44  | 25.38  | 12.41  | 6.04   | 64.35  |
| Sulfur Dioxide               |        | --                                     | --     | --     | --     | --     | --     | --     | --     |

Table B-8 (Cont'd). Car 21, Fuel No. 2, 10,000 Miles

| Test Number,<br>Aldehydes and Ketones       | EMISSION RATE, MG/KM (Except as Noted) |            |            |            |            |            |            |             |
|---------------------------------------------|----------------------------------------|------------|------------|------------|------------|------------|------------|-------------|
|                                             | FTP                                    | SET        | HFET       | RVCC       | FTP        | SET        | HFET       | RVCC        |
| Formaldehyde                                | 0.70                                   | 1.54       | 1.34       | 0.00       | 0.51       | 1.24       | 1.44       | 0.00        |
| Acetaldehyde                                | 0.09                                   | 0.13       | 0.31       | 1.85       | 0.19       | 0.00       | 0.33       | 0.00        |
| Acetone                                     | 0.00                                   | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       | 0.00        |
| Isobutyraldehyde                            | 0.25                                   | 0.00       | 0.00       | 1.38       | 2.82       | 0.51       | 0.00       | 14.69       |
| Methyl Ethyl Ketone                         | 0.00                                   | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       | 0.00        |
| Crotonaldehyde                              | --                                     | --         | --         | --         | --         | --         | --         | --          |
| Hexanaldehyde                               | 0.00                                   | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       | 0.00        |
| Benzaldehyde                                | --                                     | --         | --         | --         | --         | --         | --         | --          |
| Aldehydes and Ketones<br>Total as % of THC, | 1.0<br>4.0                             | 1.7<br>3.4 | 1.7<br>5.7 | 3.2<br>1.3 | 3.5<br>1.4 | 1.8<br>3.6 | 1.8<br>9.0 | 14.7<br>7.0 |
| Individual Hydrocarbons                     |                                        |            |            |            |            |            |            |             |
| Methane                                     | 42.77                                  | 22.01      | 13.77      | 68.42      | 50.11      | 21.66      | 14.05      | 66.54       |
| Ethylene                                    | 10.02                                  | 0.28       | 0.00       | 3.16       | 10.40      | 0.22       | 0.00       | 3.66        |
| Ethane                                      | 7.56                                   | 2.54       | 0.00       | 27.11      | 12.51      | 2.72       | 1.23       | 19.61       |
| Acetylene                                   | 3.85                                   | 0.00       | 0.00       | 0.00       | 9.92       | 0.00       | 0.00       | 0.00        |
| Propane                                     | 0.34                                   | 0.00       | 0.00       | 0.00       | 0.53       | 0.00       | 0.00       | 0.00        |
| Propylene                                   | 3.77                                   | 0.00       | 0.00       | 0.00       | 3.71       | 0.00       | 0.00       | 0.00        |
| Benzene                                     | 11.59                                  | 0.58       | 0.00       | 9.35       | 12.68      | 0.77       | 0.18       | 9.16        |
| Toluene                                     | 13.18                                  | 0.00       | 0.00       | 0.00       | 15.47      | 0.00       | 0.00       | 0.00        |
| Total Individual HC                         | 93.1                                   | 25.4       | 13.8       | 108.0      | 115.5      | 27.4       | 15.5       | 99.0        |
| Total as % of THC,                          | 37.2                                   | 50.8       | 46.0       | 43.2       | 46.2       | 54.8       | 77.5       | 47.1        |
| Organic Sulfides                            |                                        |            |            |            |            |            |            |             |
| Carbonyl Sulfide                            | 0.00                                   | 0.24       | 0.00       | 0.32       | --         | 0.42       | 0.17       | 0.63        |
| Methyl Sulfide                              | 0.01                                   | 0.00       | 0.02       | 0.30       | 0.02       | 0.02       | 0.03       | 0.34        |
| Ethyl Sulfide                               | 0.00                                   | 0.00       | 0.00       | 0.14       | 0.01       | 0.00       | 0.00       | 0.00        |
| Methyl Disulfide                            | 0.01                                   | 0.00       | 0.01       | 0.17       | 0.00       | 0.00       | 0.00       | 0.21        |
| Organic Amines                              |                                        |            |            |            |            |            |            |             |
| Monomethylamine                             | 0.00                                   | 0.00       | 0.00       | 0.00       | --         | 0.02       | 0.00       | 0.00        |
| Dimethylamine                               | 0.00                                   | 0.00       | 0.00       | 0.08       | --         | 0.02       | 0.05       | 0.28        |
| Trimethylamine                              | 0.00                                   | 0.00       | 0.00       | 0.00       | --         | 0.00       | 0.00       | 0.00        |
| Diethylamine                                | 0.00                                   | 0.00       | 0.00       | 0.00       | --         | 0.00       | 0.00       | 0.00        |
| Triethylamine                               | 0.00                                   | 0.00       | 0.00       | 0.00       | --         | 0.00       | 0.00       | 0.00        |

Table B-9. Car 21, Fuel No. 3, 10,000 Miles

| Test Number,<br>Barometer,<br>Humidity,<br>Temperature,<br>Total Fuel Sulfur,<br>Carbon Dioxide,<br>Fuel Cons.,<br>Regulated Emissions<br>Hydrocarbons (THC),<br>Carbon Monoxide,<br>Oxides of Nitrogen,<br>Particulates<br>Sulfate<br>Compound Group Totals<br>Aldehydes & Ketones<br>Individual Hydrocarbons<br>Organic Sulfides<br>Organic Amines<br>Other Compounds<br>Ammonia<br>Cyanide & Cyanogen<br>DMRA<br>Hydrogen Sulfide<br>Nickel Carbonyl<br>Nitrous Oxide<br>Sulfur Dioxide | EMISSION RATE, MG/KM (Except as Noted) |        |        |        |        |        |        |        |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|--------|--------|--------|--------|--------|--------|--------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | FTP                                    | SET    | HFET   | NYCC   | FTP    | SET    | HFET   | NYCC   |
| 212311                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 212311                                 | 212312 | 212313 | 212314 | 212321 | 212322 | 212323 | 212324 |
| 730.9                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 736.6                                  | 736.6  | 736.6  | 736.6  | 735.8  | 735.8  | 736.3  | 736.3  |
| 12.6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 12.2                                   | 12.2   | 13.6   | 12.8   | 12.2   | 13.6   | 19.0   | 12.5   |
| 23.9                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 26.7                                   | 26.7   | 27.2   | 27.2   | 25.0   | 27.2   | 26.7   | 26.1   |
| 25.10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 20.14                                  | 18.25  | 18.25  | 48.21  | 25.32  | 20.27  | 18.03  | 47.69  |
| 254.8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 207.6                                  | 189.4  | 189.4  | 496.2  | 255.8  | 209.3  | 186.3  | 486.3  |
| 11.08                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 8.89                                   | 8.05   | 8.05   | 21.28  | 11.17  | 8.94   | 7.96   | 21.04  |
| 0.27                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.09                                   | 0.03   | 0.03   | 0.29   | 0.27   | 0.05   | 0.03   | 0.49   |
| 2.51                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.22                                   | 0.08   | 0.08   | 0.83   | 3.25   | 0.06   | 0.01   | 3.33   |
| 0.45                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.61                                   | 0.67   | 0.67   | 0.65   | 0.44   | 0.66   | 0.76   | 0.59   |
| 1.23                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 19.87                                  | 24.80  | 24.80  | 0.10   | 1.62   | 33.76  | 36.63  | 0.10   |
| 1.63                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 32.89                                  | 45.30  | 45.30  | 0.07   | 2.13   | 55.52  | 67.72  | 0.07   |
| 3.4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 4.7                                    | 2.9    | 2.9    | 11.3   | 2.6    | 2.7    | 1.4    | 16.7   |
| 120.8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 10.0                                   | 20.9   | 20.9   | 134.5  | 139.9  | 29.1   | 16.7   | 263.4  |
| 0.16                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.30                                   | 0.09   | 0.09   | 0.67   | 0.00   | 0.08   | 0.18   | 0.09   |
| 0.03                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.01                                   | 0.01   | 0.01   | 0.11   | 0.03   | 0.02   | 0.02   | 0.14   |
| 2.01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 1.07                                   | 3.21   | 3.21   | 10.11  | 2.80   | 0.80   | 1.56   | 7.53   |
| 1.50                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.90                                   | 0.61   | 0.61   | 5.16   | 0.18   | 0.30   | 0.92   | 0.51   |
| --                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | --                                     | --     | --     | --     | --     | --     | --     | --     |
| 0.00                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| 0.00                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| 27.44                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 9.93                                   | 8.76   | 8.76   | 50.55  | 26.72  | 9.41   | 5.95   | 47.59  |
| --                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | --                                     | --     | --     | --     | --     | --     | --     | --     |

Table B-9 (Cont'd). Car 21, Fuel No. 3, 10,000 Miles

| Test Number, Aldehydes and Ketones      | EMISSION RATE, MG/KM (Except as Noted) |       |       |        |       |       |
|-----------------------------------------|----------------------------------------|-------|-------|--------|-------|-------|
|                                         | FTP                                    | SET   | HFET  | NVCC   | FTP   | SET   |
| Formaldehyde                            | 3.79                                   | 4.43  | 2.93  | 10.19  | 1.23  | 2.28  |
| Acetaldehyde                            | 0.06                                   | 0.20  | 0.00  | 1.12   | 0.54  | 0.45  |
| Acetone                                 | 0.00                                   | 0.07  | 0.00  | 0.00   | 0.00  | 0.00  |
| Isobutyraldehyde                        | 0.00                                   | 0.00  | 0.00  | 0.00   | 0.00  | 0.00  |
| Methyl Ethyl Ketone                     | 0.00                                   | 0.00  | 0.00  | 0.00   | 0.00  | 0.00  |
| Crotonaldehyde                          | 0.00                                   | 0.00  | 0.00  | 0.00   | 0.00  | 0.00  |
| Hexanaldehyde                           | 0.00                                   | 0.00  | 0.00  | 0.00   | 0.00  | 0.00  |
| Benzaldehyde                            | 0.00                                   | 0.00  | 0.00  | 0.00   | 0.00  | 0.00  |
| Aldehydes and Ketones Total as % of THC | 3.4                                    | 4.7   | 2.9   | 11.3   | 2.6   | 2.7   |
|                                         | 1.3                                    | 5.2   | 9.7   | 3.9    | 1.0   | 5.4   |
| Individual Hydrocarbons                 |                                        |       |       |        |       |       |
| Methane                                 | 76.43                                  | 12.59 | 19.27 | 105.70 | 87.47 | 25.68 |
| Ethylene                                | 14.42                                  | 0.67  | 0.48  | 3.39   | 16.99 | 0.06  |
| Ethane                                  | 11.71                                  | 3.81  | 2.10  | 23.93  | 12.77 | 3.33  |
| Acetylene                               | 3.51                                   | 0.00  | 0.00  | 0.00   | 4.70  | 0.00  |
| Propane                                 | 1.77                                   | 0.12  | 0.00  | 1.48   | 2.03  | 0.00  |
| Propylene                               | 4.76                                   | 0.00  | 0.00  | 0.00   | 5.66  | 0.00  |
| Benzene                                 | 5.23                                   | 0.77  | 0.00  | 0.00   | 6.55  | 0.00  |
| Toluene                                 | 2.95                                   | 0.00  | 0.00  | 0.00   | 3.75  | 0.00  |
| Total Individual HC                     | 120.8                                  | 30.0  | 20.9  | 134.5  | 139.9 | 29.1  |
| Total as % of THC                       | 44.7                                   | 42.2  | 69.7  | 46.4   | 51.8  | 58.2  |
| Organic Sulfides                        |                                        |       |       |        |       |       |
| Carbonyl Sulfide                        | 0.15                                   | 0.29  | 0.09  | 0.67   | 0.00  | 0.08  |
| Methyl Sulfide                          | 0.00                                   | 0.01  | 0.00  | 0.00   | 0.00  | 0.00  |
| Ethyl Sulfide                           | 0.00                                   | 0.00  | 0.00  | 0.00   | 0.00  | 0.00  |
| Methyl bisulfide                        | 0.01                                   | 0.00  | 0.00  | 0.00   | 0.00  | 0.00  |
| Organic Amines                          |                                        |       |       |        |       |       |
| Monomethylamine                         | 0.00                                   | 0.00  | 0.00  | 0.01   | 0.01  | 0.00  |
| Dimethylamine                           | 0.03                                   | 0.01  | 0.01  | 0.10   | 0.02  | 0.02  |
| Trimethylamine                          | 0.00                                   | 0.00  | 0.00  | 0.00   | 0.00  | 0.00  |
| Diethylamine                            | 0.00                                   | 0.00  | 0.00  | 0.00   | 0.00  | 0.00  |
| Triethylamine                           | 0.00                                   | 0.00  | 0.00  | 0.00   | 0.00  | 0.00  |

Table B-10. CAR 21, FUEL NO. 1, 15,000 MILES

|                              | EMISSION RATE, MG/KM (Except as Noted) |        |        |        |        |        |        |        |
|------------------------------|----------------------------------------|--------|--------|--------|--------|--------|--------|--------|
|                              | FTP                                    | SET    | HFET   | NYCC   | FTP    | SET    | HFET   | NYCC   |
| Test Number, FVMPST          | 213111                                 | 213112 | 213113 | 213114 | 213121 | 213122 | 213123 | 213124 |
| Barometer, mm Hg             | 741.7                                  | 741.7  | 741.7  | 741.7  | 743.2  | 743.7  | 743.7  | 743.7  |
| Humidity, g/kg               | 13.9                                   | 13.7   | 13.7   | 13.5   | 10.4   | 10.6   | 11.3   | 11.3   |
| Temperature, °C              | 24.4                                   | 26.7   | 26.7   | 27.2   | 22.2   | 25.0   | 26.7   | 26.7   |
| Total Fuel Sulfur, mg/km     | 0.82                                   | 0.66   | 0.55   | 1.51   | 0.86   | 0.70   | 0.62   | 1.52   |
| Carbon Dioxide, g/km         | 250.9                                  | 204.8  | 171.3  | 468.1  | 263.6  | 218.4  | 192.7  | 470.5  |
| Fuel Cons., L/100 km         | 10.94                                  | 8.76   | 7.32   | 20.06  | 11.46  | 9.34   | 8.23   | 20.16  |
| <b>Regulated Emissions</b>   |                                        |        |        |        |        |        |        |        |
| Hydrocarbons (THC), g/km     | 0.25                                   | 0.05   | 0.02   | 0.21   | 0.23   | 0.05   | 0.02   | 0.23   |
| Carbon Monoxide, g/km        | 2.93                                   | 0.23   | 0.03   | 0.73   | 2.72   | 0.16   | 0.03   | 0.63   |
| Oxides of Nitrogen, g/km     | 0.42                                   | 0.57   | 0.53   | 0.59   | 0.38   | 0.56   | 0.58   | 0.57   |
| <b>Particulates</b>          |                                        |        |        |        |        |        |        |        |
| Sulfate                      | 0.14                                   | 1.95   | 3.68   | 0.27   | 0.16   | 0.18   | 0.43   | 0.04   |
| Sulfate as % of TFS, %       | 5.69                                   | 98.48  | 223.0  | 5.96   | 6.20   | 8.57   | 23.12  | 0.88   |
| <b>Compound Group Totals</b> |                                        |        |        |        |        |        |        |        |
| Aldehydes & Ketones          | 12.1                                   | 4.5    | 1.7    | 69.2   | 3.1    | 4.1    | 2.1    | 45.4   |
| Individual Hydrocarbons      | 115.7                                  | 30.5   | 12.4   | 104.1  | 108.1  | 30.1   | 17.2   | 96.7   |
| Organic Sulfides             | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.22   | 0.09   | 0.03   | 0.19   |
| Organic Amines               | 0.01                                   | 0.00   | 0.00   | 0.01   | 0.02   | 0.00   | 0.04   | 0.04   |
| <b>Other Compounds</b>       |                                        |        |        |        |        |        |        |        |
| Ammonia                      | 2.56                                   | 0.60   | 0.89   | 5.78   | 1.55   | 0.64   | 1.16   | 5.83   |
| Cyanide & Cyanogen           | 1.70                                   | 0.35   | 0.12   | 2.97   | 1.84   | 0.61   | 0.53   | 10.11  |
| DMRA                         | --                                     | --     | --     | --     | --     | --     | --     | --     |
| Hydrogen Sulfide             | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Nickel Carbonyl              | 0.00                                   | 0.00   | 0.00   | 0.00   | --     | --     | --     | --     |
| Nitrous Oxide                | 15.92                                  | 10.28  | 6.13   | 41.88  | 21.27  | 9.40   | 4.96   | 79.38  |
| Sulfur Dioxide               | 10.72                                  | 26.54  | 3.61   | 13.54  | 11.78  | 6.63   | 4.54   | 34.16  |

Table B-10 (Cont'd), CAR 21, FUEL NO. 1, 15,000 MILES

| Test Number,<br>Aldehydes and Ketones       | EMISSION RATE, MG/KM (Except as Noted) |            |            |            |            |            |             |              |
|---------------------------------------------|----------------------------------------|------------|------------|------------|------------|------------|-------------|--------------|
|                                             | FTP                                    | SET        | HFET       | NVCC       | FTP        | SET        | HFET        | NVCC         |
| Formaldehyde                                | 0.29                                   | 2.30       | 0.54       | 0.00       | 1.37       | 1.37       | 0.00        | 2.89         |
| Acetaldehyde                                | 0.21                                   | 0.16       | 0.14       | 1.94       | 0.54       | 0.71       | 0.38        | 3.91         |
| Acetone                                     | 0.00                                   | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       | 0.00        | 0.00         |
| Isobutyraldehyde                            | 11.29                                  | 2.06       | 0.50       | --         | 1.14       | 1.41       | 1.71        | 38.62        |
| Methyl Ethyl Ketone                         | 0.00                                   | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       | 0.00        | 0.00         |
| Crotonaldehyde                              | --                                     | --         | --         | --         | --         | --         | --          | --           |
| Hexanaldehyde                               | 0.30                                   | 0.00       | 0.50       | 3.02       | 0.00       | 0.61       | 0.00        | 0.00         |
| Benzaldehyde                                | --                                     | --         | --         | --         | --         | --         | --          | --           |
| Aldehydes and Ketones<br>Total as % of THC, | 12.1<br>4.8                            | 4.5<br>9.0 | 1.7<br>6.5 | 5.0<br>2.3 | 3.1<br>1.3 | 4.1<br>8.2 | 2.1<br>10.5 | 45.4<br>19.7 |
| Individual Hydrocarbons                     |                                        |            |            |            |            |            |             |              |
| Methane                                     | 55.34                                  | 25.53      | 11.09      | 75.38      | 56.27      | 24.59      | 10.40       | 62.86        |
| Ethylene                                    | 11.54                                  | 0.73       | 0.04       | 4.08       | 10.50      | 0.92       | 1.54        | 9.91         |
| Ethane                                      | 7.89                                   | 2.97       | 1.15       | 17.52      | 8.37       | 3.51       | 3.49        | 10.62        |
| Acetylene                                   | 5.15                                   | 0.00       | 0.00       | 0.00       | 4.68       | 0.00       | 0.00        | 0.00         |
| Propane                                     | 5.88                                   | 0.47       | 0.00       | 0.57       | 0.39       | 0.00       | 0.00        | 0.29         |
| Propylene                                   | 4.12                                   | 0.00       | 0.00       | 0.00       | 3.10       | 0.00       | 0.00        | 0.00         |
| Benzene                                     | 11.81                                  | 0.84       | 0.11       | 6.58       | 12.15      | 1.12       | 1.78        | 13.04        |
| Toluene                                     | 13.98                                  | 0.00       | 0.00       | 0.00       | 12.68      | 0.00       | 0.00        | 0.00         |
| Total Individual HC                         | 115.7                                  | 30.5       | 12.4       | 104.1      | 108.1      | 30.1       | 17.2        | 96.7         |
| Total as % of THC,                          | 46.3                                   | 61.0       | 62.0       | 49.6       | 47.0       | 60.2       | 86.0        | 42.0         |
| Organic Sulfides                            |                                        |            |            |            |            |            |             |              |
| Carbonyl Sulfide                            | 0.00                                   | 0.00       | 0.00       | 0.00       | 0.22       | 0.00       | 0.00        | 0.00         |
| Methyl Sulfide                              | 0.00                                   | 0.00       | 0.00       | 0.00       | 0.00       | 0.09       | 0.03        | 0.00         |
| Ethyl Sulfide                               | 0.00                                   | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       | 0.00        | 0.14         |
| Methyl Disulfide                            | 0.00                                   | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       | 0.00        | 0.05         |
| Organic Amines                              |                                        |            |            |            |            |            |             |              |
| Monomethylamine                             | 0.01                                   | 0.00       | 0.00       | 0.00       | 0.02       | 0.00       | 0.03        | 0.00         |
| Dimethylamine                               | 0.00                                   | 0.00       | 0.00       | 0.01       | 0.00       | 0.00       | 0.00        | 0.04         |
| Trimethylamine                              | 0.00                                   | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       | 0.01        | 0.00         |
| Diethylamine                                | 0.00                                   | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       | 0.00        | 0.00         |
| Triethylamine                               | 0.00                                   | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       | 0.00        | 0.00         |



Table B-11. CAR 21, FUEL NO. 2, 15,000 MILES

|                              | EMISSION RATE, MG/KM (Except as Noted) |        |        |        |        |        |        |        |
|------------------------------|----------------------------------------|--------|--------|--------|--------|--------|--------|--------|
|                              | FTP                                    | SET    | HFET   | NYCC   | FTP    | SET    | HFET   | NYCC   |
| Test Number, PWHST           | 213211                                 | 213212 | 213213 | 213214 | 213221 | 213222 | 213223 | 213224 |
| Barometer, mm Hg             | 742.2                                  | 743.2  | 743.2  | 743.2  | 740.4  | 740.4  | 739.4  | 739.4  |
| Humidity, %                  | 9.7                                    | 9.7    | 10.4   | 10.4   | 11.6   | 11.4   | 10.2   | 9.7    |
| Temperature, °C              | 22.2                                   | 25.6   | 27.2   | 25.6   | 24.4   | 25.0   | 27.8   | 27.2   |
| Total Fuel Sulfur, mg/km     | 26.02                                  | 21.35  | 18.93  | 46.00  | 24.80  | 19.97  | 18.08  | 43.77  |
| Carbon Dioxide, g/km         | 265.3                                  | 221.0  | 196.3  | 475.4  | 251.6  | 206.7  | 187.3  | 452.7  |
| Fuel Cons., L/100 km         | 11.52                                  | 9.45   | 8.38   | 20.36  | 10.98  | 8.84   | 8.00   | 19.38  |
| <b>Regulated Emissions</b>   |                                        |        |        |        |        |        |        |        |
| Hydrocarbons (THC), g/km     | 0.20                                   | 0.04   | 0.02   | 0.19   | 0.24   | 0.05   | 0.03   | 0.13   |
| Carbon Monoxide, g/km        | 2.49                                   | 0.16   | 0.03   | 0.64   | 3.12   | 0.18   | 0.04   | 0.57   |
| Oxides of Nitrogen, g/km     | 0.46                                   | 0.64   | 0.64   | 0.65   | 0.42   | 0.61   | 0.60   | 0.61   |
| <b>Particulates</b>          |                                        |        |        |        |        |        |        |        |
| Sulfate                      | 0.07                                   | 7.34   | 15.47  | 0.10   | 0.48   | 7.85   | 20.94  | 0.38   |
| Sulfate as % of TFS, %       | 0.09                                   | 11.46  | 27.24  | 0.07   | 0.65   | 13.10  | 38.61  | 0.29   |
| <b>Compound Group Totals</b> |                                        |        |        |        |        |        |        |        |
| Aldehydes & Ketones          | 10.7                                   | 11.0   | 3.8    | 40.2   | 2.9    | 1.6    | 2.5    | 7.8    |
| Individual Hydrocarbons      | 94.9                                   | 27.2   | 16.2   | 86.6   | 104.5  | 26.4   | 14.5   | 74.9   |
| Organic Sulfides             | 0.08                                   | 0.00   | 0.00   | 0.23   | 0.00   | 0.10   | 0.00   | 0.00   |
| Organic Amines               | 0.07                                   | 0.02   | 0.04   | 0.05   | 0.06   | 0.00   | 0.00   | 0.49   |
| <b>Other Compounds</b>       |                                        |        |        |        |        |        |        |        |
| Ammonia                      | 2.30                                   | 1.61   | 3.62   | 43.55  | 1.67   | 0.98   | 0.94   | 26.74  |
| Cyanide & Cyanogen           | 1.53                                   | 0.65   | 0.16   | 9.50   | 0.90   | 0.10   | 0.35   | 4.45   |
| DMRA                         | --                                     | --     | --     | --     | --     | --     | --     | --     |
| Hydrogen Sulfide             | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Nickel Carbonyl              | 0.00                                   | 0.00   | 0.00   | 0.00   | --     | --     | --     | --     |
| Nitrous Oxide                | 23.62                                  | 10.61  | 7.46   | 63.31  | 23.48  | 9.92   | 7.42   | 46.10  |
| Sulfur Dioxide               | 27.44                                  | 36.90  | 13.88  | 45.73  | 27.32  | 30.81  | 17.12  | 48.84  |

Table B-11 (Cont'd). CAR 21, FUEL NO. 2, 15,000 MILES

| Test Number,<br>Aldehydes and Ketones       | EMISSION RATE, MG/KM (Except as Noted) |              |             |              |            |            |
|---------------------------------------------|----------------------------------------|--------------|-------------|--------------|------------|------------|
|                                             | FTP                                    | SET          | HFET        | NYCC         | FTP        | SET        |
| Formaldehyde                                | 0.86                                   | 0.75         | 1.47        | 0.00         | 0.63       | 0.90       |
| Acetaldehyde                                | 0.09                                   | 0.08         | 0.52        | 2.76         | 0.28       | 0.53       |
| Acetone                                     | 0.00                                   | 0.00         | 0.00        | 0.00         | 0.00       | 0.00       |
| Isobutyraldehyde                            | 9.78                                   | 10.13        | 1.50        | 32.82        | 1.95       | 0.15       |
| Methyl Ethyl Ketone                         | 0.00                                   | 0.00         | 0.00        | 0.00         | 0.00       | 0.00       |
| Crotonaldehyde                              | --                                     | --           | --          | --           | --         | --         |
| Hexanaldehyde                               | 0.00                                   | 0.00         | 0.32        | 4.57         | 0.00       | 0.00       |
| Benzaldehyde                                | --                                     | --           | --          | --           | --         | --         |
| Aldehydes and Ketones<br>Total as % of THC, | 10.7<br>5.4                            | 11.0<br>27.5 | 3.8<br>19.0 | 40.2<br>21.2 | 2.9<br>1.2 | 1.6<br>3.2 |
| Individual Hydrocarbons                     |                                        |              |             |              |            |            |
| Methane                                     | 43.98                                  | 22.95        | 14.51       | 59.14        | 45.73      | 22.75      |
| Ethylene                                    | 10.41                                  | 0.57         | 0.00        | 5.72         | 12.88      | 0.28       |
| Ethane                                      | 7.40                                   | 3.11         | 1.47        | 17.79        | 7.01       | 3.06       |
| Acetylene                                   | 3.27                                   | 0.00         | 0.00        | 0.00         | 5.03       | 0.00       |
| Propane                                     | 0.66                                   | 0.18         | 0.13        | 0.86         | 0.00       | 0.13       |
| Propylene                                   | 4.10                                   | 0.00         | 0.00        | 0.00         | 4.97       | 0.00       |
| Benzene                                     | 11.35                                  | 0.42         | 0.08        | 4.05         | 13.44      | 0.20       |
| Toluene                                     | 13.72                                  | 0.00         | 0.00        | 0.00         | 15.44      | 0.00       |
| Total Individual HC                         | 94.9                                   | 27.2         | 16.2        | 86.6         | 104.5      | 26.4       |
| Total as % of THC,                          | 47.5                                   | 68.0         | 81.0        | 45.6         | 43.5       | 52.8       |
| Organic Sulfides                            |                                        |              |             |              |            |            |
| Carbonyl Sulfide                            | 0.00                                   | 0.00         | 0.00        | 0.00         | 0.00       | 0.06       |
| Methyl Sulfide                              | 0.00                                   | 0.00         | 0.00        | 0.00         | 0.00       | 0.01       |
| Ethyl Sulfide                               | 0.05                                   | 0.00         | 0.00        | 0.18         | 0.00       | 0.03       |
| Methyl Disulfide                            | 0.03                                   | 0.00         | 0.00        | 0.05         | 0.00       | 0.00       |
| Organic Amines                              |                                        |              |             |              |            |            |
| Monomethylamine                             | 0.04                                   | 0.01         | 0.00        | 0.00         | 0.00       | 0.00       |
| Dimethylamine                               | 0.03                                   | 0.00         | 0.04        | 0.05         | 0.06       | 0.00       |
| Trimethylamine                              | 0.00                                   | 0.01         | 0.00        | 0.00         | 0.00       | 0.00       |
| Diethylamine                                | 0.00                                   | 0.00         | 0.00        | 0.00         | 0.00       | 0.00       |
| Triethylamine                               | 0.00                                   | 0.00         | 0.00        | 0.00         | 0.00       | 0.00       |

Table B-12. CAR 21, FUEL NO. 3, 15,000 MILES

|                          |                 | EMISSION RATE, MG/KM (Except as Noted) |        |        |        |        |        |        |        |
|--------------------------|-----------------|----------------------------------------|--------|--------|--------|--------|--------|--------|--------|
| Test Number,             | PVWFST<br>mm Hg | FTP                                    |        | SET    |        | HFET   |        | NVCC   |        |
|                          |                 | 213311                                 | 213312 | 213313 | 213314 | 213321 | 213322 | 213323 | 213324 |
| Barometer,               | mm Hg           | 741.0                                  | 741.7  | 741.7  | 741.7  | 740.7  | 741.2  | 741.2  | 741.2  |
| Humidity,                | g/kg            | 10.4                                   | 10.9   | 9.2    | 9.7    | 12.6   | 10.6   | 11.7   | 11.4   |
| Temperature,             | °C              | 23.9                                   | 24.4   | 28.3   | 27.2   | 23.9   | 26.7   | 27.8   | 28.3   |
| Total Fuel Sulfur, mg/km |                 | 24.66                                  | 20.41  | 18.06  | 48.40  | 23.83  | 19.57  | 17.00  | 42.39  |
| Carbon Dioxide, g/km     |                 | 250.9                                  | 210.7  | 186.6  | 499.4  | 241.1  | 202.0  | 175.6  | 437.2  |
| Fuel Cons., l/100 km     |                 | 10.88                                  | 9.00   | 7.97   | 21.36  | 10.52  | 8.64   | 7.50   | 18.71  |
| Regulated Emissions      |                 |                                        |        |        |        |        |        |        |        |
| Hydrocarbons (THC), g/km |                 | 0.20                                   | 0.05   | 0.02   | 0.17   | 0.24   | 0.05   | 0.03   | 0.17   |
| Carbon Monoxide, g/km    |                 | 2.14                                   | 0.08   | 0.02   | 0.25   | 2.90   | 0.13   | 0.05   | 0.39   |
| Oxides of Nitrogen, g/km |                 | 0.41                                   | 0.62   | 0.58   | 0.64   | 0.39   | 0.58   | 0.57   | 0.58   |
| Particulates             |                 |                                        |        |        |        |        |        |        |        |
| Sulfate                  |                 | 6.58                                   | 3.88   | 33.30  | 0.40   | 4.18   | 33.12  | 28.97  | 1.43   |
| Sulfate as % of TFS, %   |                 | 8.89                                   | 6.34   | 61.46  | 0.28   | 5.85   | 56.41  | 56.80  | 1.12   |
| Compound Group Totals    |                 |                                        |        |        |        |        |        |        |        |
| Aldehydes & Ketones      |                 | 10.6                                   | 4.7    | 4.5    | 36.8   | 4.7    | 2.1    | 1.7    | 43.3   |
| Individual Hydrocarbons  |                 | 81.5                                   | 29.6   | 17.6   | 89.4   | 95.1   | 30.8   | 18.6   | 80.7   |
| Organic Sulfides         |                 | 0.03                                   | 0.01   | 0.00   | 1.64   | 0.01   | 0.00   | 0.00   | 0.25   |
| Organic Amines           |                 | 0.07                                   | 0.02   | 0.08   | 0.35   | 0.04   | 0.04   | 0.02   | 0.04   |
| Other Compounds          |                 |                                        |        |        |        |        |        |        |        |
| Ammonia                  |                 | 2.20                                   | 1.39   | 1.42   | 17.04  | 2.51   | 1.23   | 2.35   | 17.21  |
| Cyanide & Cyanogen       |                 | 0.96                                   | 0.35   | 0.09   | 5.63   | 0.63   | 0.05   | 0.02   | 1.24   |
| DMNA                     |                 | --                                     | --     | --     | --     | --     | --     | --     | --     |
| Hydrogen Sulfide         |                 | 0.00                                   | 0.00   | 0.00   | 0.00   | --     | --     | --     | --     |
| Nickel Carbonyl          |                 | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Nitrous Oxide            |                 | 23.69                                  | 11.26  | 6.95   | 54.52  | --     | --     | --     | --     |
| Sulfur Dioxide           |                 | 18.06                                  | 24.04  | 10.69  | 54.84  | 32.48  | 27.60  | 21.00  | 50.85  |

Table B-12 (Cont'd). CAR 21, FUEL NO. 3, 15,000 MILES

| Test Number,<br>PMFEST 213311               | EMISSION RATE, MG/KM (Except as Noted) |            |             |              |            |            |            |              |
|---------------------------------------------|----------------------------------------|------------|-------------|--------------|------------|------------|------------|--------------|
|                                             | FTP                                    | SET        | HFET        | NYCC         | FTP        | SET        | HFET       | NYCC         |
| Aldehydes and Ketones                       |                                        | 213312     | 213313      | 213314       | 213321     | 213322     | 213323     | 213324       |
| Formaldehyde                                | 1.88                                   | 2.54       | 2.86        | 0.00         | 2.92       | 1.46       | 1.40       | 14.52        |
| Acetaldehyde                                | 0.45                                   | 0.31       | 0.49        | 3.11         | 0.54       | 0.22       | 0.33       | 7.02         |
| Acetone                                     | 0.00                                   | 0.00       | 0.00        | 0.00         | 0.00       | 0.00       | 0.00       | 0.00         |
| Isobutyraldehyde                            | 6.33                                   | 1.02       | 0.57        | 26.81        | 0.54       | 0.00       | 0.00       | 17.77        |
| Methyl Ethyl Ketone                         | 0.00                                   | 0.00       | 0.00        | 0.00         | 0.00       | 0.00       | 0.00       | 0.00         |
| Crotonaldehyde                              | --                                     | --         | --          | --           | --         | --         | --         | --           |
| Hexanaldehyde                               | 1.90                                   | 0.78       | 0.54        | 6.90         | 0.65       | 0.42       | 0.00       | 3.94         |
| Benzaldehyde                                | --                                     | --         | --          | --           | --         | --         | --         | --           |
| Aldehydes and Ketones<br>Total as % of THC, | 10.6<br>5.3                            | 4.7<br>9.4 | 4.5<br>22.5 | 36.8<br>21.6 | 4.7<br>2.0 | 2.1<br>4.2 | 1.7<br>5.7 | 43.3<br>25.5 |
| Individual Hydrocarbons                     |                                        |            |             |              |            |            |            |              |
| Methane                                     | 47.13                                  | 25.09      | 15.39       | 67.70        | 53.90      | 26.17      | 16.31      | 61.46        |
| Ethylene                                    | 9.33                                   | 0.57       | 0.04        | 2.40         | 12.62      | 0.29       | 0.04       | 0.82         |
| Ethane                                      | 8.53                                   | 3.84       | 2.15        | 18.94        | 9.06       | 4.11       | 2.14       | 17.00        |
| Acetylene                                   | 3.50                                   | 0.00       | 0.00        | 0.00         | 5.18       | 0.00       | 0.00       | 0.00         |
| Propane                                     | 0.60                                   | 0.06       | 0.00        | 0.31         | 0.66       | 0.24       | 0.13       | 0.86         |
| Propylene                                   | 4.99                                   | 0.00       | 0.00        | 0.00         | 4.63       | 0.00       | 0.00       | 0.00         |
| Benzene                                     | 3.82                                   | 0.00       | 0.00        | 0.00         | 4.66       | 0.01       | 0.01       | 0.53         |
| Toluene                                     | 3.62                                   | 0.00       | 0.00        | 0.00         | 4.40       | 0.00       | 0.00       | 0.00         |
| Total Individual HC                         | 81.5                                   | 29.6       | 17.6        | 89.4         | 95.1       | 30.8       | 18.6       | 80.7         |
| Total as % of THC,                          | 40.8                                   | 59.2       | 88.0        | 52.6         | 39.6       | 61.6       | 62.0       | 47.5         |
| Organic Sulfides                            |                                        |            |             |              |            |            |            |              |
| Carbonyl Sulfide                            | 0.00                                   | 0.00       | 0.00        | 1.50         | 0.00       | 0.00       | 0.00       | 0.25         |
| Methyl Sulfide                              | 0.03                                   | 0.01       | 0.00        | 0.14         | 0.01       | 0.00       | 0.00       | 0.00         |
| Ethyl Sulfide                               | 0.00                                   | 0.00       | 0.00        | 0.00         | 0.00       | 0.00       | 0.00       | 0.00         |
| Methyl Disulfide                            | 0.00                                   | 0.00       | 0.00        | 0.00         | 0.00       | 0.00       | 0.00       | 0.00         |
| Organic Amines                              |                                        |            |             |              |            |            |            |              |
| Monomethylamine                             | 0.01                                   | 0.00       | 0.03        | 0.00         | 0.01       | 0.00       | 0.00       | 0.02         |
| Dimethylamine                               | 0.06                                   | 0.02       | 0.05        | 0.35         | 0.03       | 0.04       | 0.02       | 0.02         |
| Trimethylamine                              | 0.00                                   | 0.00       | 0.00        | 0.00         | 0.00       | 0.00       | 0.00       | 0.00         |
| Diethylamine                                | 0.00                                   | 0.00       | 0.00        | 0.00         | 0.00       | 0.00       | 0.00       | 0.00         |
| Triethylamine                               | 0.00                                   | 0.00       | 0.00        | 0.00         | 0.00       | 0.00       | 0.00       | 0.00         |

Table B-13. Car 22, Fuel No. 1, Initial Mileage

| Test Number,<br>Barometer,<br>Humidity,<br>Temperature,<br>Total Fuel Sulfur,<br>Carbon Dioxide,<br>Fuel Cons., | PVWFS<br>mm Hg<br>g/kg<br>°C<br>mg/km<br>g/km<br>g/100 km | EMISSION RATE, MG/KM (Except as Noted) |        |        |        |        |        |        |        |
|-----------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|----------------------------------------|--------|--------|--------|--------|--------|--------|--------|
|                                                                                                                 |                                                           | FTP                                    | SET    | HFET   | NYCC   | FTP    | SET    | HFET   | NYCC   |
| 220111                                                                                                          | 748.8                                                     | 220111                                 | 220112 | 220113 | 220114 | 220121 | 220122 | 220123 | 220124 |
| 748.8                                                                                                           | 749.3                                                     | 749.3                                  | 749.3  | 749.3  | 749.3  | 747.5  | 747.8  | 747.8  | 747.8  |
| 5.9                                                                                                             | 5.6                                                       | 6.3                                    | 6.3    | 6.3    | 5.2    | 6.2    | 7.3    | 7.3    | 7.3    |
| 25.0                                                                                                            | 27.2                                                      | 25.6                                   | 25.6   | 25.6   | 26.7   | 24.4   | 27.8   | 26.1   | 26.1   |
| 0.84                                                                                                            | 0.65                                                      | 0.60                                   | 0.60   | 0.60   | 1.38   | 0.83   | 0.66   | 0.60   | 1.37   |
| 251.4                                                                                                           | 201.4                                                     | 185.1                                  | 185.1  | 185.1  | 427.7  | 249.1  | 204.8  | 184.9  | 422.0  |
| 11.13                                                                                                           | 8.61                                                      | 7.91                                   | 7.91   | 7.91   | 18.38  | 11.02  | 8.76   | 7.90   | 18.13  |
| Regulated Emissions                                                                                             |                                                           |                                        |        |        |        |        |        |        |        |
| Hydrocarbons (THC), g/km                                                                                        | 0.25                                                      | 0.02                                   | 0.02   | 0.02   | 0.07   | 0.26   | 0.02   | 0.02   | 0.07   |
| Carbon Monoxide, g/km                                                                                           | 5.40                                                      | 0.20                                   | 0.16   | 0.16   | 1.76   | 5.19   | 0.24   | 0.11   | 1.65   |
| Oxides of Nitrogen, g/km                                                                                        | 0.87                                                      | 0.96                                   | 0.98   | 0.98   | 1.09   | 0.89   | 0.97   | 1.00   | 1.02   |
| Particulates                                                                                                    |                                                           |                                        |        |        |        |        |        |        |        |
| Sulfate                                                                                                         | 0.00                                                      | 0.01                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Sulfate as % of TFS, %                                                                                          | 0.00                                                      | 0.51                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Compound Group Totals                                                                                           |                                                           |                                        |        |        |        |        |        |        |        |
| Aldehydes & Ketones                                                                                             | 0.6                                                       | 0.2                                    | 0.1    | 0.1    | 4.6    | 0.6    | 0.3    | 0.4    | 4.8    |
| Individual Hydrocarbons                                                                                         | 114.3                                                     | 12.9                                   | 12.6   | 12.6   | 34.2   | 128.1  | 16.7   | 14.9   | 54.7   |
| Organic Sulfides                                                                                                | 0.13                                                      | 0.11                                   | 0.09   | 0.09   | 0.79   | 0.00   | 0.10   | 0.00   | 0.44   |
| Organic Amines                                                                                                  | 0.00                                                      | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.02   | 0.01   | 0.00   |
| Other Compounds                                                                                                 |                                                           |                                        |        |        |        |        |        |        |        |
| Ammonia                                                                                                         | 3.08                                                      | 2.73                                   | 6.19   | 6.19   | 10.89  | 0.57   | 2.28   | 1.42   | 9.28   |
| Cyanide & Cyanogen                                                                                              | 1.20                                                      | 0.06                                   | 0.00   | 0.00   | 1.62   | 1.31   | 0.20   | 0.06   | 0.00   |
| DHNA                                                                                                            | --                                                        | --                                     | --     | --     | --     | --     | --     | --     | --     |
| Hydrogen Sulfide                                                                                                | 0.00                                                      | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Nickel Carbonyl                                                                                                 | 0.00                                                      | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Nitrous Oxide                                                                                                   | 23.25                                                     | 4.09                                   | 3.44   | 3.44   | 20.03  | 11.98  | 5.68   | 2.43   | 23.67  |
| Sulfur Dioxide                                                                                                  | --                                                        | --                                     | --     | --     | --     | --     | --     | --     | --     |

Table B-13 (Cont'd). Car 22, Fuel No. 1, Initial Mileage

| Test Number, PUMFST<br>Aldehydes and Ketones  | EMISSION RATE, MG/KH (Except as Noted) |            |            |            |            |            |            |            |
|-----------------------------------------------|----------------------------------------|------------|------------|------------|------------|------------|------------|------------|
|                                               | FTP                                    | SET        | HFET       | NYCC       | FTP        | SET        | HFET       | NYCC       |
| Formaldehyde                                  | 0.48                                   | 0.06       | 0.08       | 0.34       | 0.17       | 0.07       | 0.08       | 0.62       |
| Acetaldehyde                                  | 0.00                                   | 0.00       | 0.00       | 2.34       | 0.00       | 0.00       | 0.00       | 0.00       |
| Acetone                                       | 0.00                                   | 0.00       | 0.00       | 0.00       | 0.10       | 0.12       | 0.20       | 0.00       |
| Isobutyraldehyde                              | 0.00                                   | 0.00       | 0.00       | 0.00       | 0.34       | 0.00       | 0.00       | 4.17       |
| Methyl Ethyl Ketone                           | 0.16                                   | 0.15       | 0.00       | 1.90       | 0.00       | 0.13       | 0.14       | 0.00       |
| Crotonaldehyde                                | --                                     | --         | --         | --         | --         | --         | --         | --         |
| Hexanaldehyde                                 | 0.00                                   | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       |
| Benzaldehyde                                  | --                                     | --         | --         | --         | --         | --         | --         | --         |
| Aldehydes and Ketones<br>Total as % of THC, * | 0.6<br>0.2                             | 0.2<br>1.0 | 0.1<br>0.5 | 4.6<br>6.6 | 0.6<br>0.2 | 0.3<br>1.5 | 0.4<br>2.0 | 4.8<br>6.9 |
| Individual Hydrocarbons                       |                                        |            |            |            |            |            |            |            |
| Methane                                       | 28.39                                  | 10.32      | 11.01      | 27.77      | 28.08      | 12.67      | 13.16      | 45.25      |
| Ethylene                                      | 18.97                                  | 0.93       | 0.21       | 1.41       | 20.86      | 0.98       | 0.42       | 2.67       |
| Ethane                                        | 4.16                                   | 1.01       | 1.03       | 3.66       | 4.38       | 1.42       | 1.26       | 5.08       |
| Acetylene                                     | 4.98                                   | 0.00       | 0.00       | 0.00       | 5.72       | 0.00       | 0.00       | 0.00       |
| Propane                                       | 1.27                                   | 0.06       | 0.00       | 0.59       | 0.96       | 0.07       | 0.00       | 0.32       |
| Propylene                                     | 8.59                                   | 0.00       | 0.00       | 0.00       | 15.09      | 0.00       | 0.00       | 0.00       |
| Benzene                                       | 20.72                                  | 0.60       | 0.39       | 0.81       | 22.54      | 1.33       | 0.08       | 1.37       |
| Toluene                                       | 27.26                                  | 0.00       | 0.00       | 0.00       | 30.46      | 0.26       | 0.00       | 0.00       |
| Total Individual HC                           | 114.3                                  | 12.9       | 12.6       | 34.2       | 128.1      | 16.7       | 14.9       | 54.7       |
| Total as % of THC, *                          | 45.7                                   | 64.5       | 63.0       | 48.9       | 49.3       | 83.5       | 74.5       | 78.1       |
| Organic Sulfides                              |                                        |            |            |            |            |            |            |            |
| Carbonyl Sulfide                              | 0.13                                   | 0.11       | 0.09       | 0.79       | 0.00       | 0.07       | 0.00       | 0.44       |
| Methyl Sulfide                                | 0.00                                   | 0.00       | 0.00       | 0.00       | 0.00       | 0.03       | 0.00       | 0.00       |
| Ethyl Sulfide                                 | 0.00                                   | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       |
| Methyl Disulfide                              | 0.00                                   | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       |
| Organic Amines                                |                                        |            |            |            |            |            |            |            |
| Monomethylamine                               | 0.00                                   | 0.00       | 0.00       | 0.00       | 0.00       | 0.02       | 0.00       | 0.00       |
| Dimethylamine                                 | 0.00                                   | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       | 0.01       | 0.00       |
| Trimethylamine                                | 0.00                                   | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       |
| Diethylamine                                  | 0.00                                   | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       |
| Triethylamine                                 | 0.00                                   | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       |

Table B-14. Car 22, Fuel No. 2, Initial Mileage

|                          | EMISSION RATE, MG/KM (Except as Noted) |        |        |        |        |        |        |        |
|--------------------------|----------------------------------------|--------|--------|--------|--------|--------|--------|--------|
|                          | FTP                                    | SET    | HFET   | NYCC   | FTP    | SET    | HFET   | NYCC   |
| Test Number, PUMPST      | 220211                                 | 220212 | 220213 | 220214 | 220221 | 220222 | 220223 | 220224 |
| Barometer, mm Hg         | 740.7                                  | 740.4  | 740.7  | 740.7  | 742.4  | 742.9  | 742.9  | 742.9  |
| Humidity, g/kg           | 6.5                                    | 9.0    | 12.6   | 9.5    | 13.1   | 10.6   | 9.9    | 10.6   |
| Temperature, °C          | 23.9                                   | 25.6   | 23.9   | 26.1   | 26.1   | 28.3   | 28.3   | 28.3   |
| Total Fuel Sulfur, mg/km | 23.53                                  | 19.57  | 17.49  | 39.21  | 23.47  | 19.47  | 17.61  | 38.46  |
| Carbon Dioxide, g/km     | 234.1                                  | 202.6  | 181.2  | 402.5  | 233.9  | 201.5  | 182.5  | 397.0  |
| Fuel Cons., l/100 km     | 10.41                                  | 8.66   | 7.74   | 17.36  | 10.39  | 8.62   | 7.80   | 17.03  |
| Regulated Emissions      |                                        |        |        |        |        |        |        |        |
| Hydrocarbons (THC), g/km | 0.27                                   | 0.03   | 0.02   | 0.06   | 0.24   | 0.02   | 0.01   | 0.04   |
| Carbon Monoxide, g/km    | 5.80                                   | 0.14   | 0.08   | 2.52   | 5.55   | 0.25   | 0.11   | 1.13   |
| Oxides of Nitrogen, g/km | 0.84                                   | 1.09   | 1.16   | 1.05   | 0.78   | 0.91   | 0.85   | 0.96   |
| Particulates             |                                        |        |        |        |        |        |        |        |
| Sulfate                  | 0.05                                   | 0.07   | 0.14   | 0.19   | 0.05   | 0.10   | 0.34   | 0.09   |
| Sulfate as % of TFS, %   | 0.07                                   | 0.12   | 0.27   | 0.16   | 0.07   | 0.17   | 0.64   | 0.08   |
| Compound Group Totals    |                                        |        |        |        |        |        |        |        |
| Aldehydes & Ketones      | 0.1                                    | 0.0    | 0.0    | 1.8    | 0.2    | 0.1    | 0.2    | 0.6    |
| Individual Hydrocarbons  | 116.7                                  | 14.2   | 14.0   | 47.4   | 109.9  | 17.8   | 13.6   | 33.9   |
| Organic Sulfides         | 0.04                                   | 0.04   | 0.00   | 2.35   | 0.27   | 0.06   | 0.20   | 0.33   |
| Organic Amines           | 0.02                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Other Compounds          |                                        |        |        |        |        |        |        |        |
| Ammonia                  | 1.95                                   | 4.24   | 0.99   | 22.57  | 4.26   | 2.04   | 0.85   | 26.67  |
| Cyanide & Cyanogen       | 3.97                                   | 0.17   | 0.28   | 2.90   | 1.66   | 1.24   | 0.37   | 0.92   |
| DHNA                     | --                                     | --     | --     | --     | --     | --     | --     | --     |
| Hydrogen Sulfide         | 0.04                                   | 0.00   | 0.00   | 0.00   | 0.04   | 0.00   | 0.00   | 0.00   |
| Nickel Carbonyl          | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Nitrous Oxide            | 19.53                                  | 6.07   | 4.27   | 22.43  | 19.34  | 5.47   | 2.55   | 16.06  |
| Sulfur Dioxide           | --                                     | --     | --     | --     | --     | --     | --     | --     |



Table B-14 (Cont'd). Car 22, Fuel No. 2, Initial Mileage

| EMISSION RATE, MG/KM (Except as Noted) |       |       |       |       |       |       |       |
|----------------------------------------|-------|-------|-------|-------|-------|-------|-------|
| Test Number, PUMPST                    | FTP   |       | HFET  |       | NYCC  |       | NYCC  |
|                                        | SET   |       | HFET  |       | FTP   | SET   |       |
| Aldehydes and Ketones                  |       |       |       |       |       |       |       |
| Formaldehyde                           | 0.03  |       | 0.00  |       | 0.08  | 0.13  | 0.15  |
| Acetaldehyde                           | 0.00  |       | 0.00  |       | 0.00  | 0.00  | 0.00  |
| Acetone                                | 0.00  |       | 0.00  |       | 0.11  | 0.00  | 0.00  |
| Isobutyraldehyde                       | 0.00  |       | 0.00  |       | 0.00  | 0.00  | 0.00  |
| Methyl Ethyl Ketone                    | 0.06  |       | 0.00  |       | 0.00  | 0.00  | 0.00  |
| Crotonaldehyde                         | --    | --    | --    | --    | --    | --    | --    |
| Hexanaldehyde                          | 0.00  |       | 0.00  |       | 0.00  | 0.00  | 0.00  |
| Benzaldehyde                           | --    | --    | --    | --    | --    | --    | --    |
| Aldehydes and Ketones                  |       |       |       |       |       |       |       |
| Total as % of THC, A                   | 0.1   | 0.0   | 0.0   |       | 0.2   | 0.1   | 0.2   |
|                                        | 0.0   | 0.0   | 0.0   |       | 0.1   | 0.5   | 2.0   |
| Individual Hydrocarbons                |       |       |       |       |       |       |       |
| Methane                                | 23.18 | 11.52 | 12.16 | 38.49 | 21.60 | 13.89 | 11.85 |
| Ethylene                               | 21.30 | 0.91  | 0.34  | 2.26  | 27.17 | 1.45  | 0.45  |
| Ethane                                 | 3.31  | 1.08  | 1.01  | 4.02  | 3.17  | 1.60  | 1.09  |
| Acetylene                              | 6.43  | 0.00  | 0.00  | 0.00  | 6.47  | 0.00  | 0.00  |
| Propane                                | 1.65  | 0.16  | 0.05  | 0.00  | 1.53  | 0.09  | 0.00  |
| Propylene                              | 9.93  | 0.00  | 0.00  | 0.00  | 9.04  | 0.00  | 0.00  |
| Benzene                                | 21.09 | 0.52  | 0.38  | 2.60  | 19.23 | 0.76  | 0.21  |
| Toluene                                | 29.84 | 0.00  | 0.02  | 0.05  | 27.71 | 0.00  | 0.00  |
| Total Individual HC                    | 116.7 | 14.2  | 14.0  | 47.4  | 109.9 | 17.8  | 13.6  |
| Total as % of THC, A                   | 43.2  | 47.3  | 70.0  | 79.0  | 45.8  | 89.0  | --    |
| Organic Sulfides                       |       |       |       |       |       |       |       |
| Carbonyl Sulfide                       | 0.01  | 0.04  | 0.00  | 0.37  | 0.17  | 0.02  | 0.13  |
| Methyl Sulfide                         | 0.01  | 0.00  | 0.00  | 1.67  | 0.10  | 0.04  | 0.07  |
| Ethyl Sulfide                          | 0.02  | 0.00  | 0.00  | 0.21  | 0.00  | 0.00  | 0.00  |
| Methyl Disulfide                       | 0.00  | 0.00  | 0.00  | 0.10  | 0.00  | 0.00  | 0.00  |
| Organic Amines                         |       |       |       |       |       |       |       |
| Monomethylamine                        | 0.01  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  |
| Dimethylamine                          | 0.01  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  |
| Trimethylamine                         | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  |
| Diethylamine                           | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  |
| Triethylamine                          | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  |

Table B-15. Car 22, Fuel No. 3, Initial Mileage

|                          | EMISSION RATE, MG/EM (Except as Noted) |        |        |        |        |        |        |        |
|--------------------------|----------------------------------------|--------|--------|--------|--------|--------|--------|--------|
|                          | FTP                                    | SET    | HPET   | NYCC   | FTP    | SET    | HPET   | NYCC   |
| Test Number, FMFST       | 220311                                 | 220312 | 220313 | 220314 | 220321 | 220322 | 220323 | 220324 |
| Barometer, mm Hg         | 739.1                                  | 739.9  | 738.9  | 735.1  | 736.9  | 738.9  | 738.9  | 738.9  |
| Humidity, g/kg           | 11.7                                   | 9.5    | 8.8    | 10.3   | 8.6    | 10.0   | 9.5    | 10.4   |
| Temperature, °C          | 26.1                                   | 27.8   | 27.8   | 26.1   | 25.0   | 26.7   | 27.8   | 27.2   |
| Total Fuel Sulfur, mg/km | 23.88                                  | 18.68  | 16.89  | 38.14  | 24.21  | 19.07  | 17.27  | 36.98  |
| Carbon Dioxide, g/km     | 234.9                                  | 192.4  | 173.8  | 393.3  | 238.1  | 196.0  | 177.7  | 374.2  |
| Fuel Cons., l/100 km     | 10.54                                  | 8.24   | 7.45   | 16.83  | 10.69  | 8.42   | 7.62   | 16.32  |
| Regulated Emissions      |                                        |        |        |        |        |        |        |        |
| Hydrocarbons (THC), g/km | 0.27                                   | 0.03   | 0.03   | 0.02   | 0.31   | 0.03   | 0.03   | 0.08   |
| Carbon Monoxide, g/km    | 7.09                                   | 0.39   | 0.46   | 0.62   | 7.32   | 0.71   | 0.52   | 5.02   |
| Oxides of Nitrogen, g/km | 0.74                                   | 0.57   | 0.31   | 1.10   | 0.70   | 0.48   | 0.35   | 0.53   |
| Particulates             |                                        |        |        |        |        |        |        |        |
| Sulfate                  | 0.14                                   | 0.04   | 0.05   | 0.10   | 0.04   | 0.07   | 0.08   | 0.08   |
| Sulfate as a of TFS, %   | 0.20                                   | 0.07   | 0.10   | 0.09   | 0.06   | 0.12   | 0.15   | 0.07   |
| Compound Group Totals    |                                        |        |        |        |        |        |        |        |
| Aldehydes & Ketones      | 0.3                                    | 0.3    | 0.4    | 2.8    | 0.4    | 0.2    | 0.3    | 1.6    |
| Individual Hydrocarbons  | 102.5                                  | 18.8   | 18.8   | 37.0   | 109.9  | 22.4   | 17.4   | 48.7   |
| Organic Sulfides         | 0.21                                   | 0.28   | 0.07   | 0.14   | 0.15   | 0.12   | 0.29   | 0.04   |
| Organic Amines           | 0.01                                   | 0.00   | 0.00   | 0.11   | 0.00   | 0.00   | 0.00   | 0.03   |
| Other Compounds          |                                        |        |        |        |        |        |        |        |
| Ammonia                  | 4.71                                   | 1.25   | 2.29   | 31.72  | 3.24   | 2.41   | 4.76   | 17.43  |
| Cyanide & Cyanogen       | 3.33                                   | 1.76   | 2.73   | 2.47   | 3.01   | 8.94   | 3.09   | 1.71   |
| DMQA                     | --                                     | --     | --     | --     | --     | --     | --     | --     |
| Hydrogen Sulfide         | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Nickel Carbonyl          | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Nitrous Oxide            | 19.08                                  | 4.17   | 3.15   | 17.85  | 18.77  | 4.97   | 3.21   | 10.11  |
| Sulfur Dioxide           | --                                     | --     | --     | --     | --     | --     | --     | --     |

Table B-15 (Cont'd). Car 22, Fuel No. 3, Initial Mileage

|                         |       | EMISSION RATE, MG/EM (Except as Noted) |        |        |        |        |        |
|-------------------------|-------|----------------------------------------|--------|--------|--------|--------|--------|
|                         |       | FTP                                    | SET    | HPET   | NYCC   | FTP    | SET    |
|                         |       | 220311                                 | 220312 | 220313 | 220314 | 220321 | 220322 |
|                         |       | NYCC                                   | HPET   | NYCC   | HPET   | 220323 | 220324 |
| Test Number, PVMFST     |       |                                        |        |        |        |        |        |
| Aldehydes and Ketones   |       |                                        |        |        |        |        |        |
| Formaldehyde            | 0.25  | 0.32                                   | 0.38   | 0.00   | 0.00   | 0.26   | 0.03   |
| Acetaldehyde            | 0.00  | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Acetone                 | 0.00  | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Isobutyraldehyde        | 0.00  | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Methyl Ethyl Ketone     | 0.00  | 0.00                                   | 0.00   | 0.00   | 2.80   | 0.18   | 0.17   |
| Crotonaldehyde          | --    | --                                     | --     | --     | --     | --     | --     |
| Hexanaldehyde           | 0.00  | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Benzaldehyde            | --    | --                                     | --     | --     | --     | --     | --     |
| Aldehydes and Ketones   | 0.3   | 0.3                                    | 0.4    | 2.8    | 0.4    | 0.2    | 0.3    |
| Total as % of THC,      | 0.1   | 1.0                                    | 1.3    | 14.0   | 0.1    | 0.7    | 1.0    |
| Individual Hydrocarbons |       |                                        |        |        |        |        |        |
| Methane                 | 39.50 | 16.12                                  | 15.20  | 19.19  | 38.08  | 17.66  | 13.76  |
| Ethylene                | 26.82 | 0.57                                   | 0.63   | 2.22   | 27.74  | 0.90   | 0.54   |
| Ethane                  | 4.60  | 2.15                                   | 2.52   | 3.45   | 4.79   | 2.30   | 4.01   |
| Acetylene               | 5.88  | 0.00                                   | 0.00   | 0.00   | 8.81   | 0      | 0.00   |
| Propane                 | 0.59  | 0.00                                   | 0.15   | --     | 0.89   | 0.33   | 0.24   |
| Propylene               | 11.88 | 0.00                                   | 0.21   | 0.00   | 13.37  | 0      | 0.42   |
| Benzene                 | 7.08  | 0.00                                   | 0.11   | 0.00   | 8.83   | 0.62   | 0.11   |
| Toluene                 | 6.14  | 0.00                                   | 0.00   | 0.00   | 7.34   | 0.05   | 0.00   |
| Total Individual HC     | 102.5 | 18.8                                   | 18.8   | 24.86  | 109.9  | 17.4   | 48.7   |
| Total as % of THC,      | 38.0  | 62.7                                   | 62.7   | --     | 35.5   | 22.4   | 58.0   |
| Organic Sulfides        |       |                                        |        |        |        |        |        |
| Carbonyl Sulfide        | 0.20  | 0.10                                   | 0.03   | 0.00   | 0.08   | 0.03   | 0.18   |
| Methyl Sulfide          | 0.01  | 0.18                                   | 0.04   | 0.14   | 0.02   | 0.09   | 0.11   |
| Ethyl Sulfide           | 0.00  | 0.00                                   | 0.00   | 0.00   | 0.03   | 0.00   | 0.00   |
| Methyl Disulfide        | 0.00  | 0.00                                   | 0.00   | 0.00   | 0.02   | 0.00   | 0.00   |
| Organic Amines          |       |                                        |        |        |        |        |        |
| Monomethylamine         | 0.01  | 0.00                                   | 0.00   | 0.05   | 0.00   | 0.00   | 0.00   |
| Dimethylamine           | 0.00  | 0.00                                   | 0.00   | 0.06   | 0.00   | 0.00   | 0.01   |
| Trimethylamine          | 0.00  | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Diethylamine            | 0.00  | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.02   |
| Triethylamine           | 0.00  | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |

Table B-16. Car 22, Fuel No. 1, 5000 Miles

|                          | EMISSION RATE, MG/KM (Except as Noted) |        |        |        |        |        |        |        |
|--------------------------|----------------------------------------|--------|--------|--------|--------|--------|--------|--------|
|                          | FTP                                    | SET    | HPET   | NYCC   | FTP    | SET    | HPET   | NYCC   |
| Test Number, PW/FST      | 221111                                 | 221112 | 221113 | 221114 | 221121 | 221122 | 221123 | 221124 |
| Barometer, mm Hg         | 747.5                                  | 747.5  | 747.0  | 747.0  | 748.8  | 748.8  | 748.8  | 748.5  |
| Humidity, g/kg           | 6.0                                    | 6.8    | 8.9    | 7.4    | 8.3    | 7.6    | 7.4    | 7.4    |
| Temperature, °C          | 24.4                                   | 24.4   | 23.9   | 24.4   | 23.9   | 23.9   | 24.4   | 24.4   |
| Total Fuel Sulfur, mg/km | 0.83                                   | 0.63   | 0.62   | 1.38   | 0.85   | 0.63   | 0.61   | 1.44   |
| Carbon Dioxide, g/km     | 218.8                                  | 195.3  | 190.6  | 406.8  | 241.0  | 194.0  | 189.0  | 428.3  |
| Fuel Cons., l/100 km     | 10.96                                  | 8.40   | 8.20   | 18.32  | 11.33  | 8.37   | 8.13   | 19.11  |
| Regulated Emissions      |                                        |        |        |        |        |        |        |        |
| Hydrocarbons (THC), g/km | 0.37                                   | 0.02   | 0.01   | 0.18   | 0.46   | 0.02   | 0.01   | 0.16   |
| Carbon Monoxide, g/km    | 10.75                                  | 0.82   | 0.88   | 13.98  | 14.66  | 1.33   | 0.83   | 12.03  |
| Oxides of Nitrogen, g/km | 0.71                                   | 0.49   | 0.25   | 0.43   | 0.52   | 0.43   | 0.28   | 0.47   |
| Particulates             |                                        |        |        |        |        |        |        |        |
| Sulfate                  | 0.11                                   | 0.06   | 0.01   | 1.51   | 0.19   | 0.05   | 0.05   | 0.57   |
| Sulfate as % of TFS, %   | 4.42                                   | 3.17   | 0.54   | 36.47  | 7.45   | 2.65   | 2.73   | 13.19  |
| Compound Group Totals    |                                        |        |        |        |        |        |        |        |
| Aldehydes & Ketones      | 1.7                                    | 0.6    | 2.1    | 29.1   | 1.9    | 1.0    | 1.9    | 6.7    |
| Individual Hydrocarbons  | 183.8                                  | 17.3   | 11.4   | 116.2  | 220.3  | 18.3   | 11.1   | 116.5  |
| Organic Sulfides         | --                                     | 0.02   | 0.06   | 0.34   | 0.33   | 0.02   | 0.01   | 0.09   |
| Organic Amines           | 0.01                                   | 0.00   | 0.03   | 0.23   | 0.03   | 0.03   | 0.04   | 0.33   |
| Other Compounds          |                                        |        |        |        |        |        |        |        |
| Ammonia                  | 3.33                                   | 2.20   | 2.09   | 27.97  | 10.08  | 5.52   | 2.19   | 34.18  |
| Cyanide & Cyanogen       | 1.84                                   | 1.98   | 0.85   | 0.58   | 1.97   | 1.04   | 0.78   | 2.37   |
| DMQA                     | --                                     | --     | --     | --     | --     | --     | --     | --     |
| Hydrogen Sulfide         | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Nickel Carbonyl          | --                                     | --     | --     | --     | 0.00   | 0.00   | 0.00   | 0.00   |
| Nitrous Oxide            | 37.29                                  | 6.56   | 3.39   | 19.88  | 31.89  | 7.89   | 3.97   | 32.57  |
| Sulfur Dioxide           | --                                     | --     | --     | --     | --     | --     | --     | --     |

Table B-16 (Cont'd). Car 22, Fuel No. 1, 5000 Miles

| EMISSION RATE, MG/KM (Except as Noted)      |            |            |             |             |             |              |            |            |             |
|---------------------------------------------|------------|------------|-------------|-------------|-------------|--------------|------------|------------|-------------|
| Test Number,<br>Aldehydes and Ketones       | FTP        |            | SET         |             | HFET        |              | NVCC       |            | NVCC        |
|                                             | 221111     | 221112     | 221112      | 221113      | 221113      | 221114       | 221121     | 221122     | 221123      |
| Formaldehyde                                | 1.11       | 0.20       | 0.40        | 0.40        | 0.40        | 2.06         | 1.21       | 0.55       | 0.62        |
| Acetaldehyde                                | 0.13       | 0.00       | 0.00        | 0.00        | 0.00        | 1.69         | 0.40       | 0.32       | 0.48        |
| Acetone                                     | 0.00       | 0.00       | 0.00        | 0.00        | 0.00        | 0.00         | 0.00       | 0.00       | 0.00        |
| Isobutyraldehyde                            | 0.46       | 0.41       | 1.74        | 1.74        | 1.74        | 25.37        | 0.25       | 0.17       | 0.84        |
| Methyl Ethyl Ketone                         | 0.00       | 0.00       | 0.00        | 0.00        | 0.00        | 0.00         | 0.00       | 0.00       | 0.00        |
| Crotonaldehyde                              | --         | --         | --          | --          | --          | --           | --         | --         | --          |
| Hexanaldehyde                               | 0.00       | 0.00       | 0.00        | 0.00        | 0.00        | 0.00         | 0.00       | 0.00       | 0.00        |
| Benzaldehyde                                | --         | --         | --          | --          | --          | --           | --         | --         | --          |
| Aldehydes and Ketones<br>Total as % of THC, | 1.7<br>0.5 | 0.6<br>3.0 | 2.1<br>21.0 | 2.1<br>21.0 | 2.1<br>21.0 | 29.1<br>16.2 | 1.9<br>0.4 | 1.0<br>5.0 | 1.9<br>19.0 |
| Individual Hydrocarbons                     |            |            |             |             |             |              |            |            |             |
| Methane                                     | 50.55      | 13.47      | 9.32        | 9.32        | 9.32        | 95.74        | 66.36      | 15.27      | 9.72        |
| Ethylene                                    | 30.37      | 0.57       | 0.12        | 0.12        | 0.12        | 2.21         | 36.33      | 0.52       | 0.01        |
| Ethane                                      | 6.40       | 1.82       | 1.10        | 1.10        | 1.10        | 7.41         | 7.31       | 1.90       | 1.11        |
| Acetylene                                   | 9.14       | 0.00       | 0.00        | 0.00        | 0.00        | 0.00         | 10.22      | 0.00       | 0.00        |
| Propane                                     | 1.36       | 0.06       | 0.00        | 0.00        | 0.00        | 0.58         | 1.32       | 0.00       | 0.00        |
| Propylene                                   | 14.18      | 0.00       | 0.00        | 0.00        | 0.00        | 1.38         | 17.10      | 0.00       | 0.00        |
| Benzene                                     | 30.57      | 0.70       | 0.58        | 0.58        | 0.58        | 5.43         | 32.80      | 0.33       | 0.06        |
| Toluene                                     | 41.21      | 0.70       | 0.32        | 0.32        | 0.32        | 3.40         | 48.84      | 0.28       | 0.24        |
| Total Individual HC                         | 183.8      | 17.3       | 11.4        | 11.4        | 11.4        | 116.2        | 220.3      | 18.3       | 11.1        |
| Total as % of THC,                          | 49.7       | 86.5       | 114.0       | 114.0       | 114.0       | 64.6         | 47.9       | 91.5       | --          |
| Organic Sulfides                            |            |            |             |             |             |              |            |            |             |
| Carbonyl Sulfide                            | 0.02       | 0.00       | 0.02        | 0.02        | 0.02        | 0.23         | 0.00       | 0.00       | 0.00        |
| Methyl Sulfide                              | 0.02       | 0.01       | 0.01        | 0.01        | 0.01        | 0.00         | 0.02       | 0.01       | 0.01        |
| Ethyl Sulfide                               | --         | 0.01       | 0.03        | 0.03        | 0.03        | 0.11         | 0.29       | 0.01       | 0.00        |
| Methyl Disulfide                            | --         | 0.00       | 0.00        | 0.00        | 0.00        | 0.00         | 0.02       | 0.00       | 0.00        |
| Organic Amines                              |            |            |             |             |             |              |            |            |             |
| Monomethylamine                             | 0.00       | 0.00       | 0.00        | 0.00        | 0.00        | 0.06         | 0.00       | 0.00       | 0.00        |
| Dimethylamine                               | 0.01       | 0.00       | 0.03        | 0.03        | 0.03        | 0.17         | 0.03       | 0.03       | 0.04        |
| Trimethylamine                              | 0.00       | 0.00       | 0.00        | 0.00        | 0.00        | 0.00         | 0.00       | 0.00       | 0.00        |
| Diethylamine                                | 0.00       | 0.00       | 0.00        | 0.00        | 0.00        | 0.00         | 0.00       | 0.00       | 0.00        |
| Triethylamine                               | 0.00       | 0.00       | 0.00        | 0.00        | 0.00        | 0.00         | 0.00       | 0.00       | 0.00        |

Table B-17. CAR 22, FUEL NO. 2, 5000 MILES

|                          |        | EMISSION RATE, MG/KM (Except as Noted) |        |        |        |        |        |        |        |
|--------------------------|--------|----------------------------------------|--------|--------|--------|--------|--------|--------|--------|
| Test Number,             | PVNFST | FTP                                    |        | SET    |        | HFET   |        | NYCC   |        |
|                          |        | 221211                                 | 221212 | 221213 | 221214 | 221221 | 221222 | 221223 | 221224 |
| Barometer,               | mm Hg  | 744.5                                  | 743.5  | 743.5  | 743.5  | 742.7  | 742.7  | 742.7  | 742.7  |
| Humidity,                | g/kg   | 12.0                                   | 12.1   | 13.2   | 12.1   | 12.3   | 12.6   | 11.6   | 11.6   |
| Temperature,             | °C     | 25.0                                   | 25.0   | 27.8   | 28.3   | 24.4   | 25.6   | 26.1   | 26.1   |
| Total Fuel Sulfur, mg/km |        | 25.65                                  | 19.99  | 17.86  | 43.78  | 24.10  | 19.44  | 17.49  | 40.35  |
| Carbon Dioxide, g/km     |        | 259.4                                  | 205.7  | 184.7  | 450.8  | 243.9  | 200.7  | 181.0  | 416.2  |
| Fuel Cons., l/100 km     |        | 11.35                                  | 8.85   | 7.91   | 19.38  | 10.67  | 8.61   | 7.74   | 17.86  |
| Regulated Emissions      |        |                                        |        |        |        |        |        |        |        |
| Hydrocarbons (THC), g/km |        | 0.25                                   | 0.05   | 0.03   | 0.12   | 0.24   | 0.05   | 0.03   | 0.11   |
| Carbon Monoxide, g/km    |        | 3.71                                   | 0.96   | 0.25   | 1.81   | 3.41   | 0.50   | 0.21   | 1.27   |
| Oxides of Nitrogen, g/km |        | 0.63                                   | 0.42   | 0.39   | 0.79   | 0.61   | 0.44   | 0.37   | 0.81   |
| Particulates             |        |                                        |        |        |        |        |        |        |        |
| Sulfate                  |        | 0.11                                   | 0.12   | 0.00   | 0.15   | 0.05   | 0.08   | 0.01   | 0.13   |
| Sulfate as % of TFS, %   |        | 0.14                                   | 0.20   | 0.00   | 0.11   | 0.07   | 0.14   | 0.03   | 0.11   |
| Compound Group Totals    |        |                                        |        |        |        |        |        |        |        |
| Aldehydes & Ketones      |        | 1.2                                    | 0.4    | 1.1    | 6.8    | 5.6    | 8.1    | 0.6    | 16.1   |
| Individual Hydrocarbons  |        | 118.2                                  | 29.0   | 9.9    | 57.6   | 116.8  | 24.8   | 17.5   | 49.4   |
| Organic Sulfides         |        | 0.57                                   | 0.02   | 0.28   | 1.7    | 0.10   | 0.04   | 0.05   | 0.12   |
| Organic Amines           |        | 0.01                                   | 0.02   | 0.02   | 0.10   | 0.01   | 0.02   | 0.04   | 0.29   |
| Other Compounds          |        |                                        |        |        |        |        |        |        |        |
| Ammonia                  |        | 2.79                                   | 0.66   | 1.33   | 19.58  | 0.14   | 3.07   | 3.55   | 16.75  |
| Cyanide & Cyanogen       |        | 5.45                                   | 2.80   | 0.68   | 5.65   | 3.21   | 1.17   | 0.30   | 6.49   |
| DMRA                     |        | --                                     | --     | --     | --     | --     | --     | --     | --     |
| Hydrogen Sulfide         |        | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Nickel Carbonyl          |        | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Nitrous Oxide            |        | 30.85                                  | 7.38   | 4.77   | 23.79  | 27.38  | 10.11  | 4.53   | 33.38  |
| Sulfur Dioxide           |        | --                                     | --     | --     | --     | --     | --     | --     | --     |

Table B-17 (Cont'd). CAR 22, FUEL NO. 2, 5000 MILES

| EMISSION RATE, MG/KM (Except as Noted)      |        |            |            |            |            |            |             |            |              |
|---------------------------------------------|--------|------------|------------|------------|------------|------------|-------------|------------|--------------|
| Test Number,<br>Aldehyden and Ketones       | PUMPST | NYCC       |            |            |            | NYCC       |             |            |              |
|                                             |        | FTP        | SET        | HFET       | NYCC       | FTP        | SET         | HFET       | NYCC         |
| Formaldehyde                                | 221211 | 0.57       | 0.13       | 0.26       | 0.55       | 0.79       | 0.24        | 0.47       | 3.05         |
| Acetaldehyde                                |        | 0.53       | 0.22       | 0.00       | 0.00       | 0.00       | 0.00        | 0.00       | 0.00         |
| Acetone                                     |        | 0.12       | 0.00       | 0.00       | 0.00       | 0.00       | 0.00        | 0.00       | 0.00         |
| Isobutyraldehyde                            |        | 0.00       | 0.00       | 0.88       | 6.20       | 4.80       | 7.85        | 0.17       | 13.00        |
| Methyl Ethyl Ketone                         |        | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       | 0.00        | 0.00       | 0.00         |
| Crotonaldehyde                              |        | --         | --         | --         | --         | --         | --          | --         | --           |
| Hexanaldehyde                               |        | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       | 0.00        | 0.00       | 0.00         |
| Benzaldehyde                                |        | --         | --         | --         | --         | --         | --          | --         | --           |
| Aldehydes and Ketones<br>Total as % of THC, |        | 1.2<br>0.5 | 0.4<br>0.8 | 1.1<br>3.7 | 6.8<br>5.7 | 5.6<br>2.3 | 8.1<br>16.2 | 0.6<br>2.0 | 16.1<br>14.6 |
| Individual Hydrocarbons                     |        |            |            |            |            |            |             |            |              |
| Methane                                     |        | 36.55      | 20.62      | 6.78       | 44.50      | 36.64      | 19.95       | 15.00      | 38.60        |
| Ethylene                                    |        | 15.28      | 1.52       | 0.36       | 1.71       | 17.00      | 0.83        | 0.40       | 0.56         |
| Ethane                                      |        | 5.20       | 2.85       | 1.95       | 6.41       | 5.68       | 2.80        | 1.77       | 6.34         |
| Acetylene                                   |        | 11.82      | 0.00       | 0.00       | 0.00       | 8.48       | 0.00        | 0.00       | 0.00         |
| Propane                                     |        | 0.34       | 0.06       | 0.00       | 0.00       | 0.18       | 0.00        | 0.00       | 0.00         |
| Propylene                                   |        | 7.44       | 0.17       | 0.00       | 2.84       | 8.56       | 0.00        | 0.00       | 0.00         |
| Benzene                                     |        | 16.12      | 3.00       | 0.84       | 1.88       | 16.59      | 1.03        | 0.30       | 3.93         |
| Toluene                                     |        | 25.48      | 0.75       | 0.00       | 0.28       | 23.64      | 0.16        | 0.00       | 0.00         |
| Total Individual HC                         |        | 118.2      | 29.0       | 9.9        | 57.6       | 116.8      | 24.8        | 17.5       | 49.4         |
| Total as % of THC,                          |        | 47.3       | 58.0       | 33.0       | 48.0       | 48.7       | 49.6        | 58.3       | 44.9         |
| Organic Sulfides                            |        |            |            |            |            |            |             |            |              |
| Carbonyl Sulfide                            |        | 0.49       | 0.01       | 0.16       | 1.30       | 0.07       | 0.04        | 0.02       | 0.00         |
| Methyl Sulfide                              |        | 0.05       | 0.01       | 0.04       | 0.28       | 0.01       | 0.00        | 0.02       | 0.00         |
| Ethyl Sulfide                               |        | 0.01       | 0.00       | 0.06       | 0.00       | 0.02       | 0.00        | 0.00       | 0.00         |
| Methyl Disulfide                            |        | 0.02       | 0.00       | 0.02       | 0.11       | 0.00       | 0.00        | 0.01       | 0.12         |
| Organic Amines                              |        |            |            |            |            |            |             |            |              |
| Monomethylamine                             |        | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       | 0.00        | 0.01       | 0.02         |
| Monomethylamine                             |        | 0.01       | 0.02       | 0.02       | 0.10       | 0.01       | 0.02        | 0.03       | 0.18         |
| Trimethylamine                              |        | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       | 0.00        | 0.00       | 0.09         |
| Diethylamine                                |        | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       | 0.00        | 0.00       | 0.00         |
| Triethylamine                               |        | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       | 0.00        | 0.00       | 0.00         |



Table B-18. CAR 22, FUEL NO. 3, 5000 MILES

| Test Number,                 | PUMPST<br>Barometer,<br>mm Hg<br>Humidity,<br>g/kg<br>Temperature,<br>°C<br>Total Fuel Sulfur, mg/km<br>Carbon Dioxide, g/km<br>Fuel Cons., l/100 km | EMISSION RATE, MG/KM (Except as Noted) |       |        |        |        |        |        |        |
|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|-------|--------|--------|--------|--------|--------|--------|
|                              |                                                                                                                                                      | FTP                                    | SET   | HFET   | NYCC   | FTP    | SET    | HFET   | NYCC   |
| 221311                       | 741.4                                                                                                                                                | 221312                                 | 741.9 | 221313 | 221314 | 221321 | 221322 | 221323 | 221324 |
| 14.1                         | 11.9                                                                                                                                                 | 11.9                                   | 11.9  | 11.9   | 11.9   | 12.1   | 11.8   | 12.2   | 12.2   |
| 23.9                         | 25.6                                                                                                                                                 | 25.6                                   | 25.6  | 25.6   | 25.6   | 25.0   | 25.6   | 28.3   | 28.3   |
| 24.45                        | 19.67                                                                                                                                                | 17.39                                  | 40.53 | 17.39  | 40.53  | 24.29  | 19.00  | 17.81  | 41.90  |
| 245.8                        | 202.0                                                                                                                                                | 179.0                                  | 416.0 | 179.0  | 416.0  | 244.1  | 195.3  | 183.5  | 430.3  |
| 10.79                        | 8.68                                                                                                                                                 | 7.67                                   | 17.88 | 7.67   | 17.88  | 10.72  | 8.38   | 7.86   | 18.49  |
| <u>Regulated Emissions</u>   |                                                                                                                                                      |                                        |       |        |        |        |        |        |        |
| Hydrocarbons (THC), g/km     | 0.28                                                                                                                                                 | 0.04                                   | 0.03  | 0.09   | 0.09   | 0.28   | 0.03   | 0.03   | 0.07   |
| Carbon Monoxide, g/km        | 3.92                                                                                                                                                 | 0.79                                   | 0.42  | 1.74   | 1.74   | 3.95   | 0.64   | 0.33   | 1.73   |
| Oxides of Nitrogen, g/km     | 0.53                                                                                                                                                 | 0.35                                   | 0.29  | 0.56   | 0.56   | 0.49   | 0.33   | 0.32   | 0.62   |
| <u>Particulates</u>          |                                                                                                                                                      |                                        |       |        |        |        |        |        |        |
| Sulfate                      | 0.05                                                                                                                                                 | 0.04                                   | 0.01  | 0.10   | 0.10   | 0.10   | 0.05   | 0.01   | 0.27   |
| Sulfate as % of TFS, %       | 0.07                                                                                                                                                 | 0.07                                   | 0.02  | 0.08   | 0.08   | 0.14   | 0.09   | 0.02   | 0.21   |
| <u>Compound Group Totals</u> |                                                                                                                                                      |                                        |       |        |        |        |        |        |        |
| Aldehydes & Ketones          | 3.2                                                                                                                                                  | 0.2                                    | 0.2   | 3.1    | 3.1    | 2.0    | 0.9    | 1.2    | 16.9   |
| Individual Hydrocarbons      | 117.5                                                                                                                                                | 25.3                                   | 18.6  | 41.4   | 41.4   | 102.2  | 23.9   | 16.5   | 41.6   |
| Organic Sulfides             | 0.21                                                                                                                                                 | 0.13                                   | 0.11  | 1.43   | 1.43   | 0.00   | 0.26   | 0.00   | 0.97   |
| Organic Amines               | 0.02                                                                                                                                                 | 0.01                                   | 0.02  | 0.15   | 0.15   | 0.02   | 0.01   | 0.02   | 0.23   |
| <u>Other Compounds</u>       |                                                                                                                                                      |                                        |       |        |        |        |        |        |        |
| Ammonia                      | 3.84                                                                                                                                                 | 0.91                                   | 1.39  | 14.31  | 14.31  | 4.80   | 3.04   | 2.19   | 21.88  |
| Cyanide & Cyanogen           | 2.49                                                                                                                                                 | 3.26                                   | 2.14  | 4.45   | 4.45   | 2.40   | 2.74   | 1.50   | 4.85   |
| DMRA                         | --                                                                                                                                                   | --                                     | --    | --     | --     | --     | --     | --     | --     |
| Hydrogen Sulfide             | 0.00                                                                                                                                                 | 0.00                                   | 0.00  | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Nickel Carbonyl              | 0.00                                                                                                                                                 | 0.00                                   | 0.00  | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Nitrous Oxide                | 24.54                                                                                                                                                | 4.71                                   | 3.02  | 11.02  | 11.02  | 24.11  | 5.68   | 2.86   | 10.99  |
| Sulfur Dioxide               | --                                                                                                                                                   | --                                     | --    | --     | --     | --     | --     | --     | --     |

Table B-18 (Cont'd). CAR 22, FUEL NO. 3, 50000 MILES

| Test Number, FVMTST     | EMISSION RATE, MG/KM (Except as Noted) |       |       |       |       |       |       |       |
|-------------------------|----------------------------------------|-------|-------|-------|-------|-------|-------|-------|
|                         | FTP                                    | SET   | HFET  | NYCC  | FTP   | SET   | HFET  | NYCC  |
| Aldehydes and Ketones   |                                        |       |       |       |       |       |       |       |
| Formaldehyde            | 0.89                                   | 0.21  | 0.20  | 2.61  | 0.72  | 0.00  | 0.08  | 0.00  |
| Acetaldehyde            | 0.00                                   | 0.00  | 0.00  | 0.53  | 0.41  | 0.43  | 0.34  | 4.52  |
| Acetone                 | 0.00                                   | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.73  | 0.00  |
| Isobutyraldehyde        | 2.31                                   | 0.00  | 0.00  | 0.00  | 0.83  | 0.48  | 0.00  | 12.38 |
| Methyl Ethyl Ketone     | 0.00                                   | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  |
| Crotonaldehyde          | --                                     | --    | --    | --    | --    | --    | --    | --    |
| Hexanaldehyde           | 0.00                                   | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  |
| Benzaldehyde            | --                                     | --    | --    | --    | --    | --    | --    | --    |
| Aldehydes and Ketones   | 3.2                                    | 0.2   | 0.2   | 3.1   | 2.0   | 0.9   | 1.2   | 16.9  |
| Total as % of THC,      | 1.1                                    | 0.5   | 0.7   | 3.4   | 0.7   | 3.0   | 4.0   | 24.1  |
| Individual Hydrocarbons |                                        |       |       |       |       |       |       |       |
| Methane                 | 48.70                                  | 19.72 | 14.81 | 37.12 | 39.52 | 19.04 | 13.92 | 36.58 |
| Ethylene                | 24.03                                  | 1.28  | 0.69  | 0.00  | 19.50 | 0.77  | 0.40  | 0.27  |
| Ethane                  | 6.31                                   | 2.97  | 2.33  | 2.96  | 6.36  | 2.96  | 2.06  | 4.70  |
| Acetylene               | 11.96                                  | 0.00  | 0.00  | 0.00  | 15.37 | 0.00  | 0.00  | 0.00  |
| Propane                 | 0.38                                   | 0.00  | 0.00  | 0.00  | 0.06  | 0.00  | 0.00  | 0.00  |
| Propylene               | 12.10                                  | 0.44  | 0.08  | 0.00  | 10.22 | 0.00  | 0.00  | 0.00  |
| Benzene                 | 8.12                                   | 0.87  | 0.56  | 1.27  | 6.10  | 1.08  | 0.07  | 0.00  |
| Toluene                 | 5.93                                   | 0.00  | 0.09  | 0.00  | 5.10  | 0.00  | 0.00  | 0.00  |
| Total Individual HC     | 117.5                                  | 25.3  | 18.6  | 41.4  | 102.2 | 23.9  | 16.5  | 41.6  |
| Total as % of THC,      | 42.0                                   | 63.3  | 62.0  | 46.0  | 36.5  | 79.7  | 55.0  | 59.4  |
| Organic Sulfides        |                                        |       |       |       |       |       |       |       |
| Carbonyl Sulfide        | 0.18                                   | 0.13  | 0.06  | 0.60  | 0.00  | 0.23  | 0.00  | 0.91  |
| Methyl Sulfide          | 0.02                                   | 0.00  | 0.03  | 0.29  | 0.00  | 0.03  | 0.00  | 0.00  |
| Ethyl Sulfide           | 0.01                                   | 0.00  | 0.00  | 0.39  | 0.00  | 0.00  | 0.00  | 0.00  |
| Methyl Disulfide        | 0.00                                   | 0.00  | 0.02  | 0.15  | 0.00  | 0.00  | 0.00  | 0.06  |
| Organic Amines          |                                        |       |       |       |       |       |       |       |
| Monomethylamine         | 0.01                                   | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.04  |
| Dimethylamine           | 0.01                                   | 0.01  | 0.02  | 0.15  | 0.02  | 0.01  | 0.02  | 0.19  |
| Trimethylamine          | 0.00                                   | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  |
| Diethylamine            | 0.00                                   | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  |
| Triethylamine           | 0.00                                   | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  |

Table B-19. CAR 22, FUEL NO. 1, 10,000 MILES

| Test Number,<br>Barometer,<br>Humidity,<br>Temperature,<br>Total Fuel Sulfur, mg/km<br>Carbon Dioxide, g/km<br>Fuel Cons., g/100 km | PVNFST<br>mm Hg<br>g/kg<br>°C | EMISSION RATE, MG/KM (Except as Noted) |        |        |        |        |        |        |        |
|-------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|----------------------------------------|--------|--------|--------|--------|--------|--------|--------|
|                                                                                                                                     |                               | FTP                                    | SET    | HFET   | NYCC   | FTP    | SET    | HFET   | NYCC   |
| 222111                                                                                                                              |                               | 222111                                 | 222112 | 222113 | 222114 | 222121 | 222122 | 222123 | 222124 |
| 739.1                                                                                                                               |                               | 739.9                                  | 739.9  | 739.9  | 739.9  | 744.2  | 741.9  | 741.9  | 741.9  |
| 15.3                                                                                                                                |                               | 14.2                                   | 14.2   | 14.6   | 13.3   | 14.4   | 15.1   | 15.1   | 15.1   |
| 25.0                                                                                                                                |                               | 25.6                                   | 25.6   | 26.7   | 27.8   | 25.0   | 27.2   | 27.2   | 27.2   |
| 0.81                                                                                                                                |                               | 0.62                                   | 0.62   | 0.54   | 1.42   | 0.80   | 0.61   | 0.56   | 1.42   |
| 245.3                                                                                                                               |                               | 191.1                                  | 191.1  | 166.3  | 434.3  | 242.3  | 189.1  | 171.9  | 429.8  |
| 10.78                                                                                                                               |                               | 8.22                                   | 8.22   | 7.14   | 18.83  | 10.65  | 8.14   | 7.38   | 18.81  |
| Regulated Emissions                                                                                                                 |                               |                                        |        |        |        |        |        |        |        |
| Hydrocarbons (THC), g/km                                                                                                            |                               | 0.29                                   | 0.04   | 0.03   | 0.14   | 0.32   | 0.04   | 0.03   | 0.17   |
| Carbon Monoxide, g/km                                                                                                               |                               | 4.06                                   | 0.81   | 0.50   | 4.13   | 4.04   | 1.03   | 0.63   | 6.52   |
| Oxides of Nitrogen, g/km                                                                                                            |                               | 0.64                                   | 0.42   | 0.40   | 0.62   | 0.60   | 0.38   | 0.41   | 0.56   |
| Particulates                                                                                                                        |                               |                                        |        |        |        |        |        |        |        |
| Sulfate                                                                                                                             |                               | 0.04                                   | 0.00   | 0.02   | 0.01   | 0.03   | 0.07   | 0.00   | 0.04   |
| Sulfate as % of TFS, %                                                                                                              |                               | 1.65                                   | 0.00   | 1.23   | 0.23   | 1.25   | 3.82   | 0.00   | 0.94   |
| Compound Group Totals                                                                                                               |                               |                                        |        |        |        |        |        |        |        |
| Aldehydes & Ketones                                                                                                                 |                               | 1.2                                    | 2.0    | 0.4    | 2.2    | 4.6    | 3.2    | 3.5    | 15.6   |
| Individual Hydrocarbons                                                                                                             |                               | 120.7                                  | 26.5   | 19.0   | 91.9   | 133.3  | 27.8   | 20.5   | 93.4   |
| Organic Sulfides                                                                                                                    |                               | 0.56                                   | 0.12   | 0.02   | 14.2   | 0.07   | 0.23   | 0.00   | 0.90   |
| Organic Amines                                                                                                                      |                               | 0.04                                   | 0.00   | 0.08   | 0.84   | 0.07   | 0.12   | 0.11   | 0.15   |
| Other Compounds                                                                                                                     |                               |                                        |        |        |        |        |        |        |        |
| Ammonia                                                                                                                             |                               | 3.73                                   | 4.49   | 6.07   | 84.88  | 3.28   | 3.16   | 5.73   | 23.47  |
| Cyanide & Cyanogen                                                                                                                  |                               | 3.28                                   | 2.94   | 2.42   | 6.87   | 3.05   | 3.87   | 3.12   | 8.58   |
| DMNA                                                                                                                                |                               | --                                     | --     | --     | --     | --     | --     | --     | --     |
| Hydrogen Sulfide                                                                                                                    |                               | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Nickel Carbonyl                                                                                                                     |                               | --                                     | --     | --     | --     | 0.00   | 0.00   | 0.00   | 0.00   |
| Nitrous Oxide                                                                                                                       |                               | --                                     | --     | --     | --     | 26.17  | 5.15   | 2.82   | 16.93  |
| Sulfur Dioxide                                                                                                                      |                               | --                                     | --     | --     | --     | 11.97  | 13.60  | 17.56  | 39.49  |

Table B-19 (Cont'd). CAR 22, FUEL NO. 1, 10,000 MILES

| Test Number,<br>Aldehydes and Ketones       | EMISSION RATE, MG/KM (Except as Noted) |            |            |            |            |            |             |             |
|---------------------------------------------|----------------------------------------|------------|------------|------------|------------|------------|-------------|-------------|
|                                             | FTP                                    | SET        | HFET       | NYCC       | FTP        | SET        | HFET        | NYCC        |
| Formaldehyde                                | 0.10                                   | 0.09       | 0.26       | 0.00       | 0.37       | 0.00       | 0.00        | 0.00        |
| Acetaldehyde                                | 0.50                                   | 0.29       | 0.12       | 0.99       | 0.49       | 0.30       | 0.44        | 2.93        |
| Acetone                                     | 0.00                                   | 0.00       | 0.00       | 0.00       | 0.63       | 0.00       | 0.00        | 0.00        |
| Isobutyraldehyde                            | 1.09                                   | 1.64       | 0.00       | 1.16       | 3.11       | 2.91       | 3.06        | 12.64       |
| Methyl Ethyl Ketone                         | 0.00                                   | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       | 0.00        | 0.00        |
| Crotonaldehyde                              | --                                     | --         | --         | --         | --         | --         | --          | --          |
| Hexanaldehyde                               | 0.00                                   | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       | 0.00        | 0.00        |
| Benzaldehyde                                | --                                     | --         | --         | --         | --         | --         | --          | --          |
| Aldehydes and Ketones<br>Total as % of THC, | 1.2<br>0.4                             | 2.0<br>5.0 | 0.4<br>1.3 | 2.2<br>1.6 | 4.6<br>1.4 | 3.2<br>8.0 | 3.5<br>11.7 | 15.6<br>9.2 |
| Individual Hydrocarbons                     |                                        |            |            |            |            |            |             |             |
| Methane                                     | 45.71                                  | 19.99      | 14.99      | 67.16      | 43.25      | 20.10      | 15.34       | 65.92       |
| Ethylene                                    | 7.71                                   | 1.38       | 0.87       | 4.65       | 17.59      | 1.65       | 1.23        | 5.65        |
| Ethane                                      | 6.53                                   | 2.96       | 2.21       | 10.55      | 6.85       | 2.98       | 2.24        | 8.94        |
| Acetylene                                   | 9.18                                   | 0.00       | 0.00       | 0.00       | 7.53       | 0.00       | 0.00        | 0.00        |
| Propane                                     | 0.73                                   | 0.00       | 0.00       | 0.00       | 0.37       | 0.00       | 0.00        | 0.00        |
| Propylene                                   | 8.30                                   | 0.00       | 0.08       | 1.37       | 9.00       | 0.28       | 0.12        | 0.81        |
| Benzene                                     | 16.49                                  | 1.60       | 0.73       | 6.10       | 19.28      | 1.96       | 1.42        | 8.28        |
| Toluene                                     | 26.04                                  | 0.54       | 0.08       | 2.05       | 29.39      | 0.80       | 0.19        | 3.79        |
| Total Individual HC                         | 120.7                                  | 26.5       | 19.0       | 91.9       | 133.3      | 27.8       | 20.5        | 93.4        |
| Total as % of THC,                          | 41.6                                   | 66.3       | 63.3       | 65.6       | 41.7       | 69.5       | 68.3        | 54.9        |
| Organic Sulfides                            |                                        |            |            |            |            |            |             |             |
| Carbonyl Sulfide                            | 0.52                                   | 0.11       | 0.00       | 12.64      | 0.06       | 0.19       | 0.00        | 0.90        |
| Methyl Sulfide                              | 0.03                                   | 0.01       | 0.00       | 0.89       | 0.01       | 0.02       | 0.00        | 0.00        |
| Ethyl Sulfide                               | 0.00                                   | 0.00       | 0.02       | 0.56       | 0.00       | 0.01       | 0.00        | 0.00        |
| Methyl Disulfide                            | 0.01                                   | 0.00       | 0.00       | 0.14       | 0.00       | 0.01       | 0.00        | 0.00        |
| Organic Amines                              |                                        |            |            |            |            |            |             |             |
| Monomethylamine                             | 0.01                                   | 0.00       | 0.00       | 0.00       | 0.00       | 0.02       | 0.00        | 0.00        |
| Dimethylamine                               | 0.03                                   | 0.00       | 0.08       | 0.84       | 0.06       | 0.10       | 0.11        | 0.15        |
| Trimethylamine                              | 0.00                                   | 0.00       | 0.00       | 0.00       | 0.01       | 0.00       | 0.00        | 0.00        |
| Diethylamine                                | 0.00                                   | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       | 0.00        | 0.00        |
| Triethylamine                               | 0.00                                   | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       | 0.00        | 0.00        |

Table B-20. CAR 22, FUEL NO. 2, 10,000 MILES

| Test Number,<br>Barometer,<br>Humidity,<br>Temperature,<br><br>Total Fuel Sulfur,<br>Carbon Dioxide,<br>Fuel Cons.,<br><br>Regulated Emissions<br>Hydrocarbons (THC),<br>Carbon Monoxide,<br>Oxides of Nitrogen,<br><br>Particulates<br>Sulfate<br>Sulfate as % of TFS,<br><br>Compound Group Totals<br>Aldehydes & Ketones<br>Individual Hydrocarbons<br>Organic Sulfides<br>Organic Amines<br><br>Other Compounds<br>Ammonia<br>Cyanide & Cyanogen<br>DMNA<br><br>Hydrogen Sulfide<br>Nickel Carbonyl<br>Nitrous Oxide<br>Sulfur Dioxide | PVHFST<br>mm Hg<br>g/kg<br>°C<br>mg/km<br>g/km<br>l/100 km<br>g/km<br>g/km<br>g/km | EMISSION RATE, MG/KM (Except as Noted) |       |        |        |        |        |        |        |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|----------------------------------------|-------|--------|--------|--------|--------|--------|--------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                    | FTP                                    | SET   | HFET   | NYCC   | FTP    | SET    | HFET   | NYCC   |
| 222211                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 737.6                                                                              | 222212                                 | 737.6 | 222213 | 222214 | 222221 | 222222 | 222223 | 222224 |
| 737.6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 737.6                                                                              | 737.6                                  | 737.6 | 737.6  | 738.6  | 738.6  | 739.9  | 739.9  | 739.9  |
| 14.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 14.0                                                                               | 14.0                                   | 13.8  | 13.5   | 13.5   | 16.2   | 14.0   | 13.5   | 13.7   |
| 24.4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 24.4                                                                               | 24.4                                   | 26.7  | 27.2   | 27.2   | 25.0   | 26.1   | 27.2   | 26.7   |
| 25.64                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 19.51                                                                              | 17.17                                  | 42.93 | 25.24  | 19.45  | 17.51  | 41.82  | 180.4  | 425.8  |
| 257.9                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 200.6                                                                              | 177.1                                  | 437.0 | 11.18  | 8.61   | 7.75   | 18.51  | 0.04   | 0.18   |
| 11.35                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 8.64                                                                               | 7.60                                   | 19.00 | 0.37   | 0.05   | 0.04   | 0.63   | 0.41   | 0.79   |
| 0.33                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.04                                                                               | 0.03                                   | 0.15  | 0.47   | 1.29   | 0.66   | 0.42   | 0.02   | 0.01   |
| 4.49                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 1.04                                                                               | 0.62                                   | 4.96  | 0.04   | 0.10   | 0.03   | 0.06   | 0.04   | 0.01   |
| 0.59                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.41                                                                               | 0.41                                   | 0.69  | 0.07   | 0.05   | 0.04   | 0.10   | 0.02   | 0.01   |
| --                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.03                                                                               | 0.03                                   | 0.07  | 0.03   | 0.06   | 0.03   | 0.06   | 0.02   | 0.01   |
| --                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.05                                                                               | 0.06                                   | 0.05  | 0.03   | 0.06   | 0.04   | 0.10   | 0.04   | 0.01   |
| 3.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.4                                                                                | 1.3                                    | 13.3  | 4.8    | 3.0    | 11.0   | 0.2    | 103.8  | 0.30   |
| 150.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 31.9                                                                               | 23.3                                   | 96.9  | 171.0  | 37.9   | 25.6   | 0.00   | 0.00   | 0.30   |
| 0.25                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.06                                                                               | 0.04                                   | 3.13  | 0.08   | 0.06   | 0.00   | 0.10   | 0.00   | 0.30   |
| 0.09                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.04                                                                               | 0.05                                   | 0.39  | 0.04   | 0.00   | 0.00   | 0.00   | 0.00   | 0.30   |
| 1.97                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.55                                                                               | 3.24                                   | 45.47 | 5.38   | 17.31  | 9.90   | 35.60  | 9.90   | 35.60  |
| 3.22                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 4.98                                                                               | 2.34                                   | 10.78 | 5.89   | 5.67   | 2.86   | 9.07   | 2.86   | 9.07   |
| --                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | --                                                                                 | --                                     | --    | --     | --     | --     | --     | --     | --     |
| 0.00                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.00                                                                               | 0.00                                   | 0.00  | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| 0.00                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.00                                                                               | 0.00                                   | 0.00  | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| 29.45                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 8.09                                                                               | 5.04                                   | 21.54 | 27.12  | 10.56  | 5.49   | 45.67  | 5.49   | 45.67  |
| 9.09                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 26.09                                                                              | 55.24                                  | 81.76 | 20.11  | 49.49  | 59.77  | 23.83  | 59.77  | 23.83  |

Table B-20 (Cont'd). CAR 22, FUEL NO. 2, 10,000 MILES

| Test Number,<br>Aldehydes and Ketones       | EMISSION RATE, MG/KM (Except as Noted) |            |            |             |            |            |              |            |
|---------------------------------------------|----------------------------------------|------------|------------|-------------|------------|------------|--------------|------------|
|                                             | FTP                                    | SET        | HFET       | NYCC        | FTP        | SET        | HFET         | NYCC       |
| Formaldehyde                                | 1.59                                   | 0.00       | 0.46       | 4.33        | 0.26       | 0.00       | 0.00         | 0.00       |
| Acetaldehyde                                | 0.95                                   | 0.27       | 0.36       | 2.69        | 0.65       | 0.19       | 0.56         | 0.21       |
| Acetone                                     | 0.17                                   | 0.16       | 0.52       | 6.23        | 0.00       | 0.00       | 0.00         | 0.00       |
| Isobutyraldehyde                            | 0.39                                   | 0.00       | 0.00       | 0.00        | 3.86       | 2.79       | 10.39        | 0.00       |
| Methyl Ethyl Ketone                         | 0.00                                   | 0.00       | 0.00       | 0.00        | 0.00       | 0.00       | 0.00         | 0.00       |
| Crotonaldehyde                              | --                                     | --         | --         | --          | --         | --         | --           | --         |
| Hexanaldehyde                               | 0.00                                   | 0.00       | 0.00       | 0.00        | 0.00       | 0.00       | 0.00         | 0.00       |
| Benzaldehyde                                | --                                     | --         | --         | --          | --         | --         | --           | --         |
| Aldehydes and Ketones<br>Total as % of THC, | 3.1<br>0.9                             | 0.4<br>1.0 | 1.3<br>4.3 | 13.3<br>8.9 | 4.8<br>1.3 | 3.0<br>6.0 | 11.0<br>27.5 | 0.2<br>0.1 |
| Individual Hydrocarbons                     |                                        |            |            |             |            |            |              |            |
| Methane                                     | 44.94                                  | 22.64      | 16.93      | 61.78       | 46.58      | 25.56      | 17.62        | 68.68      |
| Ethylene                                    | 19.21                                  | 1.69       | 1.31       | 7.44        | 21.17      | 2.43       | 1.53         | 8.24       |
| Ethane                                      | 6.78                                   | 3.45       | 2.49       | 9.11        | 7.25       | 3.87       | 2.44         | 13.68      |
| Acetylene                                   | 9.72                                   | 0.00       | 0.00       | 0.00        | 8.75       | 0.00       | 0.00         | 0.00       |
| Propane                                     | 0.64                                   | 0.00       | 0.00       | 0.00        | 0.23       | 0.12       | 0.82         | 0.00       |
| Propylene                                   | 9.15                                   | 0.45       | 0.33       | 6.65        | 10.50      | 1.13       | 0.62         | 1.33       |
| Benzene                                     | 21.86                                  | 2.83       | 1.86       | 9.38        | 29.34      | 4.10       | 2.08         | 11.88      |
| Toluene                                     | 37.88                                  | 0.80       | 0.38       | 2.50        | 47.14      | 0.70       | 0.51         | 0.00       |
| Total Individual HC                         | 150.2                                  | 31.9       | 23.3       | 96.9        | 171.0      | 37.9       | 25.6         | 103.8      |
| Total as % of THC,                          | 45.5                                   | 79.8       | 77.7       | 64.6        | 46.2       | 75.8       | 64.0         | 57.7       |
| Organic Sulfides                            |                                        |            |            |             |            |            |              |            |
| Carbonyl Sulfide                            | 0.20                                   | 0.03       | 0.00       | 2.07        | 0.07       | 0.06       | 0.00         | 0.00       |
| Methyl Sulfide                              | 0.03                                   | 0.02       | 0.03       | 0.58        | 0.00       | 0.00       | 0.00         | 0.00       |
| Ethyl Sulfide                               | 0.00                                   | 0.00       | 0.00       | 0.36        | 0.00       | 0.00       | 0.00         | 0.00       |
| Methyl Disulfide                            | 0.02                                   | 0.01       | 0.01       | 0.12        | 0.01       | 0.00       | 0.00         | 0.00       |
| Organic Amines                              |                                        |            |            |             |            |            |              |            |
| Monomethylamine                             | 0.04                                   | 0.03       | 0.01       | 0.12        | 0.02       | 0.00       | 0.00         | 0.20       |
| Dimethylamine                               | 0.05                                   | 0.01       | 0.04       | 0.27        | 0.02       | 0.00       | 0.10         | 0.10       |
| Trimethylamine                              | 0.00                                   | 0.00       | 0.00       | 0.00        | 0.00       | 0.00       | 0.00         | 0.00       |
| Diethylamine                                | 0.00                                   | 0.00       | 0.00       | 0.00        | 0.00       | 0.00       | 0.00         | 0.00       |
| Triethylamine                               | 0.00                                   | 0.00       | 0.00       | 0.00        | 0.00       | 0.00       | 0.00         | 0.00       |

Table B-21. CAR 22, FUEL NO. 3, 10,000 MILES

|                          | EMISSION RATE, MG/KM (Except as Noted) |        |        |        |        |        |        |        |
|--------------------------|----------------------------------------|--------|--------|--------|--------|--------|--------|--------|
|                          | FTP                                    | SET    | HFET   | NYCC   | FTP    | SET    | HFET   | NYCC   |
| Test Number, PVMFST      | 222311                                 | 222312 | 222313 | 222314 | 222321 | 222322 | 222323 | 222324 |
| Barometer, mm Hg         | 742.2                                  | 741.2  | 741.2  | 741.2  | 739.9  | 740.4  | 740.4  | 740.4  |
| Humidity, g/kg           | 10.4                                   | 10.2   | 10.6   | 10.4   | 10.4   | 11.9   | 10.7   | 18.9   |
| Temperature, °C          | 25.6                                   | 24.4   | 26.7   | 27.2   | 23.9   | 25.6   | 26.7   | 26.7   |
| Total Fuel Sulfur, mg/km | 23.38                                  | 17.86  | 16.15  | 39.33  | 23.10  | 18.35  | 16.06  | 39.12  |
| Carbon Dioxide, g/km     | 235.1                                  | 182.4  | 165.5  | 399.6  | 230.0  | 187.9  | 163.7  | 397.3  |
| Fuel Cons., l/100 km     | 10.32                                  | 7.88   | 7.13   | 17.36  | 10.19  | 8.10   | 7.09   | 17.26  |
| Regulated Emissions      |                                        |        |        |        |        |        |        |        |
| Hydrocarbons (THC), g/km | 0.23                                   | 0.06   | 0.04   | 0.11   | 0.30   | 0.05   | 0.05   | 0.12   |
| Carbon Monoxide, g/km    | 3.78                                   | 1.37   | 0.85   | 4.29   | 5.00   | 1.08   | 1.42   | 4.27   |
| Oxides of Nitrogen, g/km | 0.59                                   | 0.35   | 0.34   | 0.63   | 0.60   | 0.41   | 0.32   | 0.84   |
| Particulates             |                                        |        |        |        |        |        |        |        |
| Sulfate                  | 0.05                                   | 0.04   | 0.04   | 0.16   | 0.05   | 0.04   | 0.02   | 0.05   |
| Sulfate as % of TFS, %   | 0.07                                   | 0.07   | 0.08   | 0.14   | 0.07   | 0.07   | 0.04   | 0.04   |
| Compound Group Totals    |                                        |        |        |        |        |        |        |        |
| Aldehydes & Ketones      | 12.6                                   | 3.7    | 5.6    | 29.0   | 2.5    | 2.7    | 1.7    | 27.5   |
| Individual Hydrocarbons  | 95.6                                   | 33.4   | 27.0   | 73.2   | 127.1  | 33.7   | 32.9   | 65.2   |
| Organic Sulfides         | 0.01                                   | 0.00   | 0.03   | 0.00   | 0.02   | 0.01   | 0.00   | 0.00   |
| Organic Amines           | 0.07                                   | 0.02   | 0.03   | 0.32   | 0.05   | 0.02   | 0.05   | 0.23   |
| Other Compounds          |                                        |        |        |        |        |        |        |        |
| Ammonia                  | 6.18                                   | 1.90   | 3.56   | 25.56  | 5.74   | 3.87   | 5.42   | 35.08  |
| Cyanide & Cyanogen       | 4.73                                   | 5.50   | 4.46   | 10.33  | 4.73   | 6.03   | 6.47   | 11.82  |
| DMMA                     | --                                     | --     | --     | --     | --     | --     | --     | --     |
| Hydrogen Sulfide         | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Nickel Carbonyl          | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Nitrous Oxide            | 30.63                                  | 5.49   | 4.39   | 22.58  | 24.35  | 6.61   | 5.64   | 14.81  |
| Sulfur Dioxide           | 6.93                                   | 24.97  | 29.84  | 28.99  | 5.78   | 25.57  | 26.82  | 18.16  |



Table B-21 (Cont'd). CAR 22, FUEL NO. 3, 10,000 MILES

|                            |       | EMISSION RATE, MG/KM (Except as Noted) |        |        |        |        |        |        |      |
|----------------------------|-------|----------------------------------------|--------|--------|--------|--------|--------|--------|------|
|                            |       | FTP                                    | SET    | HFET   | NYCC   | FTP    | SET    | HFET   | NYCC |
| Test Number, PMWFST 222311 |       | 222312                                 | 222313 | 222314 | 222321 | 222322 | 222323 | 222324 |      |
| Aldehydes and Ketones      |       |                                        |        |        |        |        |        |        |      |
| Formaldehyde               | 0.46  | 0.00                                   | 0.00   | 0.00   | 0.52   | 0.00   | 0.00   | 0.00   | 0.00 |
| Acetaldehyde               | 0.57  | 0.16                                   | 0.12   | 0.65   | 0.30   | 0.09   | 0.14   | 2.57   | 0.00 |
| Acetone                    | 0.00  | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00 |
| Isobutyraldehyde           | 10.64 | 3.50                                   | 5.52   | 28.34  | 1.66   | 2.62   | 1.59   | 20.07  | 0.00 |
| Methyl Ethyl Ketone        | 0.00  | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00 |
| Crotonaldehyde             | --    | --                                     | --     | --     | --     | --     | --     | --     | --   |
| Hexanaldehyde              | 0.91  | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 4.81   | 0.00 |
| Benzaldehyde               | --    | --                                     | --     | --     | --     | --     | --     | --     | --   |
| Aldehydes and Ketones      | 12.6  | 3.7                                    | 5.6    | 29.0   | 2.5    | 2.7    | 1.7    | 27.5   | 0.00 |
| Total as % of THC,         | 5.5   | 6.2                                    | 14.0   | 26.4   | 0.8    | 5.4    | 3.4    | 22.9   | 0.00 |
| Individual Hydrocarbons    |       |                                        |        |        |        |        |        |        |      |
| Methane                    | 43.81 | 23.53                                  | 18.38  | 58.20  | 49.00  | 23.72  | 19.74  | 52.52  | 0.00 |
| Ethylene                   | 19.67 | 2.83                                   | 2.40   | 5.45   | 23.96  | 2.52   | 4.09   | 3.74   | 0.00 |
| Ethane                     | 8.16  | 4.10                                   | 3.62   | 8.06   | 8.56   | 4.38   | 4.08   | 7.43   | 0.00 |
| Acetylene                  | 4.49  | 0.00                                   | 0.00   | 0.00   | 8.41   | 0.00   | 0.00   | 0.00   | 0.00 |
| Propane                    | 0.00  | 0.12                                   | 0.09   | 0.00   | 0.59   | 0.06   | 0.00   | 0.00   | 0.00 |
| Propylene                  | 11.38 | 1.16                                   | 1.06   | 0.78   | 12.90  | 1.12   | 1.94   | 0.53   | 0.00 |
| Benzene                    | 5.93  | 1.55                                   | 1.33   | 0.74   | 8.94   | 1.30   | 2.82   | 0.99   | 0.00 |
| Toluene                    | 2.19  | 0.16                                   | 0.08   | 0.00   | 14.73  | 0.55   | 0.21   | 0.00   | 0.00 |
| Total Individual HC        | 95.6  | 33.4                                   | 27.0   | 73.2   | 127.1  | 33.7   | 32.9   | 65.2   | 0.00 |
| Total as % of THC,         | 41.6  | 55.7                                   | 67.5   | 66.5   | 42.4   | 67.4   | 65.8   | 54.3   | 0.00 |
| Organic Sulfides           |       |                                        |        |        |        |        |        |        |      |
| Carbonyl Sulfide           | 0.01  | 0.00                                   | 0.03   | 0.00   | 0.01   | 0.01   | 0.00   | 0.00   | 0.00 |
| Methyl Sulfide             | 0.00  | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00 |
| Ethyl Sulfide              | 0.00  | 0.00                                   | 0.00   | 0.00   | 0.01   | 0.00   | 0.00   | 0.00   | 0.00 |
| Methyl Disulfide           | 0.00  | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00 |
| Organic Amines             |       |                                        |        |        |        |        |        |        |      |
| Monomethylamine            | 0.02  | 0.01                                   | 0.02   | 0.18   | 0.03   | 0.01   | 0.03   | 0.20   | 0.00 |
| Dimethylamine              | 0.05  | 0.01                                   | 0.01   | 0.14   | 0.02   | 0.01   | 0.02   | 0.03   | 0.00 |
| Trimethylamine             | 0.00  | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00 |
| Diethylamine               | 0.00  | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00 |
| Triethylamine              | 0.00  | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00 |

Table B-22. CAR 22, FUEL NO. 1, 15,000 MILES

|                          | EMISSION RATE, MG/EM (Except as Noted) |        |        |        |        |        |        |        |
|--------------------------|----------------------------------------|--------|--------|--------|--------|--------|--------|--------|
|                          | FTP                                    | SET    | HFET   | NYCC   | FTP    | SET    | HFET   | NYCC   |
| Test Number, PUMPST      | 223111                                 | 223112 | 223113 | 223114 | 223121 | 223122 | 223123 | 223124 |
| Barometer, mm Hg         | 740.2                                  | 743.7  | 743.7  | 743.7  | 743.7  | 743.5  | 743.7  | 743.7  |
| Humidity, g/kg           | 13.4                                   | 5.0    | 4.4    | 5.1    | 11.8   | 11.3   | 12.6   | 11.8   |
| Temperature, °C          | 23.9                                   | 24.4   | 24.4   | 25.6   | 23.9   | 25.0   | 25.6   | 25.6   |
| Total Fuel Sulfur, mg/km | 0.81                                   | 0.61   | 0.54   | 1.16   | 0.79   | 0.62   | 0.56   | 1.20   |
| Carbon Dioxide, g/km     | 245.6                                  | 188.3  | 167.7  | 360.8  | 233.7  | 192.1  | 174.0  | 372.4  |
| Fuel Cons., L/100 km     | 10.81                                  | 8.09   | 7.20   | 15.45  | 10.44  | 8.30   | 7.47   | 15.97  |
| Regulated Emissions      |                                        |        |        |        |        |        |        |        |
| Hydrocarbons (THC), g/km | 0.33                                   | 0.06   | 0.04   | 0.16   | 0.38   | 0.08   | 0.05   | 0.20   |
| Carbon Monoxide, g/km    | 4.22                                   | 0.61   | 0.48   | 0.39   | 6.19   | 1.32   | 0.62   | 0.69   |
| Oxides of Nitrogen, g/km | 1.15                                   | 0.71   | 0.57   | 1.43   | 1.03   | 0.70   | 0.58   | 1.32   |
| Particulates             |                                        |        |        |        |        |        |        |        |
| Sulfate                  | 0.07                                   | 0.02   | 0.02   | 0.11   | 0.13   | 0.07   | 0.02   | 0.09   |
| Sulfate as % of TFS, %   | 2.88                                   | 1.09   | 1.23   | 3.16   | 5.49   | 3.76   | 1.19   | 2.50   |
| Compound Group Totals    |                                        |        |        |        |        |        |        |        |
| Aldehydes & Ketones      | 0.4                                    | 0.4    | 3.5    | 7.4    | 6.0    | 3.0    | 1.1    | 49.8   |
| Individual Hydrocarbons  | 191.4                                  | 39.3   | 27.5   | 83.0   | 218.7  | 51.5   | 35.1   | 134.3  |
| Organic Sulfides         | 0.04                                   | 0.04   | 0.00   | 0.00   | 0.01   | 0.05   | 0.01   | 0.08   |
| Organic Amines           | 0.05                                   | 0.04   | 0.08   | 0.65   | 0.06   | 0.05   | 0.05   | 0.09   |
| Other Compounds          |                                        |        |        |        |        |        |        |        |
| Ammonia                  | 2.00                                   | 1.91   | 2.14   | 19.16  | 3.01   | 6.33   | 3.77   | 25.99  |
| Cyanide & Cyanogen       | 5.30                                   | 4.42   | 3.00   | 5.82   | 4.55   | 5.46   | 3.13   | 5.81   |
| DMBA                     | --                                     | --     | --     | --     | --     | --     | --     | --     |
| Hydrogen Sulfide         | --                                     | --     | --     | --     | --     | --     | --     | --     |
| Nickel Carbonyl          | 0.00                                   | 0.00   | 0.00   | 0.00   | --     | --     | --     | --     |
| Nitrous Oxide            | 27.85                                  | 12.89  | 7.64   | 29.38  | 28.89  | 10.51  | 7.59   | 35.71  |
| Sulfur Dioxide           | 12.63                                  | 12.83  | 15.46  | 121.05 | 13.51  | 19.28  | 21.58  | 37.38  |

BOTTOM OF  
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EMISSION RATE, MG/KM (Except as Noted)

Table B-23. CAR 22, FUEL NO. 2, 15,000 MILES

| Test Number,             | PVHST<br>mm Hg | EMISSION RATE, MG/KM (Except as Noted) |        |        |        |        |        |        |        |
|--------------------------|----------------|----------------------------------------|--------|--------|--------|--------|--------|--------|--------|
|                          |                | FTP                                    | SET    | HFET   | NYCC   | FTP    | SET    | HFET   | NYCC   |
| Humidity,<br>g/kg        | 740.4          | 223211                                 | 223212 | 223213 | 223214 | 223221 | 223222 | 223223 | 223224 |
| Temperature,<br>°C       | 6.0            | 6.0                                    | 5.5    | 7.7    | 5.0    | 737.1  | 737.6  | 737.6  | 737.6  |
| Total Fuel Sulfur, mg/km | 22.2           | 22.2                                   | 23.3   | 22.2   | 24.4   | 23.3   | 23.9   | 23.9   | 24.4   |
| Carbon Dioxide, g/km     | 23.87          | 18.56                                  | 16.11  | 16.11  | 36.71  | 24.60  | 19.07  | 17.15  | 35.88  |
| Fuel Cons., g/100 km     | 239.0          | 191.3                                  | 166.4  | 166.4  | 379.1  | 243.9  | 196.2  | 176.9  | 370.4  |
|                          | 10.57          | 8.22                                   | 7.13   | 7.13   | 16.25  | 10.89  | 8.44   | 7.59   | 15.88  |
| Regulated Emissions      |                |                                        |        |        |        |        |        |        |        |
| Hydrocarbons (THC), g/km | 0.42           | 0.06                                   | 0.04   | 0.04   | 0.11   | 0.41   | 0.07   | 0.04   | 0.14   |
| Carbon Monoxide, g/km    | 4.63           | 0.64                                   | 0.36   | 0.36   | 0.85   | 6.34   | 0.88   | 0.57   | 0.78   |
| Oxides of Nitrogen, g/km | 1.00           | 0.64                                   | 0.57   | 0.57   | 1.46   | 0.99   | 0.67   | 0.55   | 1.27   |
| Particulates             |                |                                        |        |        |        |        |        |        |        |
| Sulfate                  | 0.08           | 0.02                                   | 0.04   | 0.00   | 0.02   | 0.03   | 0.01   | 0.01   | 0.00   |
| Sulfate as % of TFS, %   | 0.11           | 0.04                                   | 0.00   | 0.00   | 0.02   | 0.04   | 0.02   | 0.02   | 0.00   |
| Compound Group Totals    |                |                                        |        |        |        |        |        |        |        |
| Aldehydes & Ketones      | 0.9            | 0.5                                    | 1.0    | 1.0    | 19.1   | 3.3    | 1.2    | 1.0    | 22.2   |
| Individual Hydrocarbons  | 215.4          | 38.9                                   | 27.9   | 27.9   | 84.4   | 218.4  | 44.2   | 32.2   | 91.5   |
| Organic Sulfides         | 0.11           | 0.00                                   | 0.01   | 0.01   | 0.00   | 0.00   | 0.11   | 0.02   | 0.10   |
| Organic Amines           | 0.04           | 0.00                                   | 0.02   | 0.02   | 0.00   | 0.04   | 0.07   | 0.06   | 0.05   |
| Other Compounds          |                |                                        |        |        |        |        |        |        |        |
| Ammonia                  | 0.41           | 0.38                                   | 1.80   | 1.80   | 8.57   | 2.21   | 2.27   | 2.17   | 38.30  |
| Cyanide & Cyanogen       | 4.55           | 4.27                                   | 2.51   | 2.51   | 6.04   | 5.09   | 6.93   | 3.24   | 3.59   |
| DMMA                     | --             | --                                     | --     | --     | --     | --     | --     | --     | --     |
| Hydrogen Sulfide         | --             | --                                     | --     | --     | --     | 0.01   | 0.06   | 0.00   | 0.00   |
| Methyl Carbonyl          | 0.00           | 0.00                                   | 0.00   | 0.00   | 0.00   | --     | --     | --     | --     |
| Nitrous Oxide            | 35.17          | 11.65                                  | 7.45   | 7.45   | 42.96  | 26.45  | 10.41  | 5.95   | 30.62  |
| Sulfur Dioxide           | 17.38          | 24.10                                  | 50.66  | 50.66  | 0.00   | 22.07  | 32.71  | 44.45  | 57.41  |

Table B-23 (Cont'd). CAR 22, FUEL NO. 2, 15,000 MILES

| Test Number,            | PVHFST 223211 | EMISSION RATE, MG/KM (Except as Noted) |       |       |       |       |       |
|-------------------------|---------------|----------------------------------------|-------|-------|-------|-------|-------|
|                         |               | FTP                                    | SET   | HFET  | NYCC  | FTP   | SET   |
| Aldehydes and Ketones   |               |                                        |       |       |       |       |       |
| Formaldehyde            | 0.68          | 0.40                                   | 0.07  | 0.14  | 3.75  | 1.89  | 0.56  |
| Acetaldehyde            | 0.07          | 0.09                                   | 0.14  | 0.14  | 3.66  | 0.70  | 0.37  |
| Acetone                 | 0.00          | 0.00                                   | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  |
| Isobutyraldehyde        | 0.00          | 0.00                                   | 0.74  | 0.74  | 11.72 | 0.00  | 0.00  |
| Methyl Ethyl Ketone     | 0.00          | 0.00                                   | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  |
| Crotonaldehyde          | --            | --                                     | --    | --    | --    | --    | --    |
| Hexanaldehyde           | 0.19          | 0.00                                   | 0.00  | 0.00  | 0.00  | 0.66  | 0.23  |
| Benzaldehyde            | --            | --                                     | --    | --    | --    | --    | --    |
| Aldehydes and Ketones   | 0.9           | 0.5                                    | 1.0   | 1.0   | 19.1  | 3.3   | 1.2   |
| Total as % of THC,      | 0.2           | 0.8                                    | 2.5   | 2.5   | 17.4  | 0.8   | 1.7   |
| Individual Hydrocarbons |               |                                        |       |       |       |       |       |
| Methane                 | 49.19         | 23.59                                  | 19.42 | 19.42 | 34.92 | 59.28 | 24.27 |
| Ethylene                | 31.38         | 3.90                                   | 1.94  | 1.94  | 14.88 | 31.27 | 4.29  |
| Ethane                  | 7.53          | 3.87                                   | 2.92  | 2.92  | 9.15  | 7.75  | 3.75  |
| Acetylene               | 16.06         | 0.00                                   | 0.00  | 0.00  | 0.00  | 21.32 | 0.00  |
| Propane                 | 5.53          | 0.06                                   | 0.04  | 0.04  | 0.29  | 1.69  | 0.18  |
| Propylene               | 12.15         | 1.38                                   | 0.33  | 0.33  | 0.55  | 11.69 | 1.25  |
| Benzene                 | 53.15         | 5.65                                   | 3.07  | 3.07  | 23.81 | 49.35 | 7.24  |
| Toluene                 | 40.39         | 0.43                                   | 0.16  | 0.16  | 0.78  | 36.07 | 2.81  |
| Total Individual HC     | 215.4         | 38.9                                   | 27.9  | 27.9  | 84.4  | 218.4 | 44.2  |
| Total as % of THC,      | 51.3          | 64.8                                   | 69.8  | 69.8  | 76.7  | 53.3  | 63.1  |
| Organic Sulfides        |               |                                        |       |       |       |       |       |
| Carbonyl Sulfide        | 0.04          | 0.00                                   | 0.00  | 0.00  | 0.00  | 0.00  | 0.08  |
| Methyl Sulfide          | 0.00          | 0.00                                   | 0.01  | 0.01  | 0.00  | 0.00  | 0.03  |
| Ethyl Sulfide           | 0.03          | 0.00                                   | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  |
| Methyl Disulfide        | 0.04          | 0.00                                   | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  |
| Organic Amines          |               |                                        |       |       |       |       |       |
| Monomethylamine         | 0.00          | 0.00                                   | 0.00  | 0.00  | 0.00  | 0.00  | 0.01  |
| Dimethylamine           | 0.04          | 0.00                                   | 0.02  | 0.02  | 0.00  | 0.04  | 0.04  |
| Trimethylamine          | 0.00          | 0.00                                   | 0.00  | 0.00  | 0.00  | 0.00  | 0.02  |
| Diethylamine            | 0.00          | 0.00                                   | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  |
| Triethylamine           | 0.00          | 0.00                                   | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  |

Table B-24. CAR 22, FUEL NO. 3, 15,000 MILES

| EMISSION RATE, MG/KM (Except as Noted)                  |                               |                                 |                                 |                                 |                                 |                                 |                                 |                                 |                                 |
|---------------------------------------------------------|-------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
|                                                         |                               | FTP                             | SET                             | HFET                            | NYCC                            | FTP                             | SET                             | HFET                            | NYCC                            |
| Test Number,<br>Barometer,<br>Humidity,<br>Temperature, | PVMPST<br>mm Hg<br>g/kg<br>°C | 223311<br>742.2<br>13.6<br>23.3 | 223312<br>742.4<br>12.3<br>24.4 | 223313<br>742.4<br>11.1<br>25.6 | 223314<br>742.4<br>12.8<br>25.0 | 223321<br>743.2<br>12.8<br>23.3 | 223322<br>743.7<br>12.8<br>25.0 | 223323<br>743.7<br>11.8<br>25.6 | 223324<br>743.7<br>12.6<br>25.6 |
|                                                         | Total Fuel Sulfur, mg/km      | 23.13                           | 18.57                           | 16.34                           | 36.79                           | 23.13                           | 18.25                           | 16.08                           | 36.31                           |
|                                                         | Carbon Dioxide, g/km          | 230.3                           | 189.7                           | 167.1                           | 377.4                           | 230.7                           | 186.1                           | 163.8                           | 371.7                           |
|                                                         | Fuel Cons.,<br>ℓ/100 km       | 10.21                           | 8.20                            | 7.21                            | 16.24                           | 10.21                           | 8.05                            | 7.10                            | 16.02                           |
| Regulated Emissions                                     |                               |                                 |                                 |                                 |                                 |                                 |                                 |                                 |                                 |
|                                                         | Hydrocarbons (THC), g/km      | 0.35                            | 0.08                            | 0.06                            | 0.14                            | 0.36                            | 0.08                            | 0.07                            | 0.15                            |
|                                                         | Carbon Monoxide, g/km         | 4.96                            | 1.32                            | 1.09                            | 1.64                            | 4.66                            | 1.46                            | 1.39                            | 2.08                            |
|                                                         | Oxides of Nitrogen, g/km      | 0.76                            | 0.43                            | 0.31                            | 1.07                            | 0.69                            | 0.41                            | 0.33                            | 0.97                            |
| Particulates                                            |                               |                                 |                                 |                                 |                                 |                                 |                                 |                                 |                                 |
|                                                         | Sulfate                       | 0.11                            | 0.00                            | 0.09                            | 0.16                            | 0.05                            | 0.00                            | 0.01                            | 0.02                            |
|                                                         | Sulfate as % of TFS, %        | 0.16                            | 0.00                            | 0.18                            | 0.14                            | 0.07                            | 0.00                            | 0.02                            | 0.02                            |
| Compound Group Totals                                   |                               |                                 |                                 |                                 |                                 |                                 |                                 |                                 |                                 |
|                                                         | Aldehydes & Ketones           | 3.4                             | 8.7                             | 5.1                             | 72.5                            | 3.9                             | 16.8                            | 7.8                             | 44.4                            |
|                                                         | Individual Hydrocarbons       | 162.7                           | 47.4                            | 34.5                            | 79.5                            | 162.2                           | 46.1                            | 41.0                            | 81.4                            |
|                                                         | Organic Sulfides              | --                              | 0.22                            | 0.02                            | 0.26                            | 0.02                            | 0.03                            | 0.01                            | 0.00                            |
|                                                         | Organic Amines                | 0.02                            | 0.03                            | 0.03                            | 0.11                            | 0.04                            | 0.03                            | 0.00                            | 0.00                            |
| Other Compounds                                         |                               |                                 |                                 |                                 |                                 |                                 |                                 |                                 |                                 |
|                                                         | Ammonia                       | 4.60                            | 6.11                            | 4.25                            | 20.37                           | 1.10                            | 1.70                            | 1.51                            | 10.74                           |
|                                                         | Cyanide & Cyanogen            | 5.05                            | 10.44                           | 9.27                            | 6.46                            | 5.76                            | 10.39                           | 16.45                           | 10.80                           |
| DMNA                                                    |                               |                                 |                                 |                                 |                                 |                                 |                                 |                                 |                                 |
|                                                         | Hydrogen Sulfide              | 0.00                            | 0.00                            | 0.00                            | 0.00                            | 0.00                            | 0.00                            | 0.00                            | 0.00                            |
|                                                         | Nickel Carbonyl               | 0.00                            | 0.00                            | 0.00                            | 0.00                            | --                              | --                              | --                              | --                              |
|                                                         | Nitrous Oxide                 | 34.22                           | 7.81                            | 3.81                            | 21.70                           | 25.42                           | 8.89                            | 5.58                            | 30.13                           |
|                                                         | Sulfur Dioxide                | 17.91                           | 43.23                           | 45.12                           | 72.26                           | 24.10                           | 50.16                           | 45.41                           | 40.68                           |

Table B-24 (Cont'd). CAR 22, FUEL NO. 3, 15,000 MILES

| Test Number, PVMFST                      | EMISSION RATE, MG/KM (Except as Noted) |        |        |        |        |        |
|------------------------------------------|----------------------------------------|--------|--------|--------|--------|--------|
|                                          | FTP                                    | SET    | HFET   | NYCC   | FTP    | SET    |
| Aldehydes and Ketones                    | 223311                                 | 223312 | 223313 | 223314 | 223321 | 223322 |
| Formaldehyde                             | 1.54                                   | 0.77   | 0.34   | 4.32   | 0.70   | 0.00   |
| Acetaldehyde                             | 0.68                                   | 0.99   | 0.51   | 10.80  | 0.00   | 0.00   |
| Acetone                                  | 0.32                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Isobutyraldehyde                         | 0.48                                   | 6.36   | 3.11   | 45.95  | 2.56   | 15.67  |
| Methyl Ethyl Ketone                      | 0.20                                   | 0.40   | 0.57   | 7.01   | 0.20   | 0.25   |
| Crotonaldehyde                           | --                                     | --     | --     | --     | --     | --     |
| Hexanaldehyde                            | 0.15                                   | 0.28   | 0.61   | 4.42   | 0.39   | 0.85   |
| Benzaldehyde                             | --                                     | --     | --     | --     | --     | --     |
| Aldehydes and Ketones Total as % of THC, | 3.4                                    | 8.7    | 5.1    | 72.5   | 3.9    | 16.8   |
|                                          | 1.0                                    | 10.9   | 8.5    | 51.8   | 1.1    | 21.0   |
| Individual Hydrocarbons                  |                                        |        |        |        |        |        |
| Methane                                  | 61.81                                  | 30.60  | 22.65  | 55.25  | 67.45  | 31.37  |
| Ethylene                                 | 29.64                                  | 4.45   | 3.11   | 7.83   | 31.95  | 4.73   |
| Ethane                                   | 10.78                                  | 6.25   | 4.36   | 12.17  | 10.57  | 6.72   |
| Acetylene                                | 12.97                                  | 0.00   | 0.00   | 0.00   | 15.95  | 0.05   |
| Propane                                  | 1.38                                   | 0.30   | 0.00   | 0.28   | 0.88   | 0.12   |
| Propylene                                | 13.63                                  | 1.77   | 1.57   | 0.00   | 15.31  | 1.42   |
| Benzene                                  | 18.87                                  | 3.82   | 2.77   | 4.01   | 11.96  | 1.71   |
| Toluene                                  | 13.61                                  | 0.21   | 0.00   | 0.00   | 8.11   | 0.00   |
| Total Individual HC                      | 162.7                                  | 47.4   | 34.5   | 79.5   | 162.2  | 46.1   |
| Total as % of THC,                       | 46.5                                   | 59.3   | 57.5   | 56.8   | 45.1   | 57.6   |
| Organic Sulfides                         |                                        |        |        |        |        |        |
| Carbonyl Sulfide                         | --                                     | 0.15   | 0.00   | 0.00   | 0.00   | 0.00   |
| Methyl Sulfide                           | --                                     | 0.07   | 0.02   | 0.26   | 0.02   | 0.03   |
| Ethyl Sulfide                            | --                                     | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Methyl Disulfide                         | --                                     | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Organic Amines                           |                                        |        |        |        |        |        |
| Monomethylamine                          | 0.00                                   | 0.02   | 0.00   | 0.00   | 0.00   | 0.00   |
| Dimethylamine                            | 0.02                                   | 0.00   | 0.03   | 0.11   | 0.04   | 0.03   |
| Trimethylamine                           | 0.00                                   | 0.01   | 0.00   | 0.00   | 0.00   | 0.00   |
| Diethylamine                             | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Triethylamine                            | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |



Table B-25. Car 23, Fuel No. 1, Initial Mileage

| Test Number,             | PUMPST<br>mm Hg | EMISSION RATE, MG/KM (Except as Noted) |        |        |        |        |        |        |        |
|--------------------------|-----------------|----------------------------------------|--------|--------|--------|--------|--------|--------|--------|
|                          |                 | FTP                                    | SET    | HFET   | NVCC   | FTP    | SET    | HFET   | NVCC   |
| Humidity,<br>°C          |                 | 230111                                 | 230112 | 230113 | 230114 | 230121 | 230122 | 230123 | 230124 |
|                          |                 | 740.7                                  | 740.7  | 740.7  | 740.7  | 733.6  | 736.3  | 733.8  | 733.8  |
|                          |                 | 13.9                                   | 11.1   | 11.4   | 13.7   | 8.9    | 10.0   | 10.1   | 10.8   |
| Temperature,             |                 | 24.4                                   | 25.6   | 26.7   | 26.7   | 26.1   | 26.7   | 26.7   | 26.7   |
| Total Fuel Sulfur, mg/km |                 | 0.88                                   | 0.75   | 0.69   | 1.47   | 0.88   | 0.76   | 0.69   | 1.39   |
| Carbon Dioxide, g/km     |                 | 269.9                                  | 230.5  | 210.5  | 450.1  | 268.9  | 231.7  | 210.9  | 423.8  |
| Fuel Cons., l/100 km     |                 | 11.69                                  | 10.02  | 9.22   | 19.49  | 11.66  | 10.05  | 9.21   | 18.44  |
| Regulated Emissions      |                 |                                        |        |        |        |        |        |        |        |
| Hydrocarbons (THC), g/km |                 | 0.12                                   | 0.04   | 0.05   | 0.07   | 0.15   | 0.05   | 0.05   | 0.11   |
| Carbon Monoxide, g/km    |                 | 2.38                                   | 2.65   | 3.38   | 4.09   | 2.43   | 2.26   | 3.04   | 5.05   |
| Oxides of Nitrogen, g/km |                 | 0.09                                   | 0.06   | 0.06   | 0.07   | 0.09   | 0.07   | 0.07   | 0.06   |
| Particulates             |                 |                                        |        |        |        |        |        |        |        |
| Sulfate                  |                 | 0.02                                   | 0.02   | 0.01   | 0.04   | 0.01   | 0.02   | 0.01   | --     |
| Sulfate as % of TFS, %   |                 | 0.76                                   | 0.89   | 0.48   | 0.91   | 0.38   | 0.88   | 0.48   | --     |
| Compound Group Totals    |                 |                                        |        |        |        |        |        |        |        |
| Aldehydes & Ketones      |                 | 0.4                                    | 0.1    | 0.1    | 1.1    | 1.7    | 0.5    | 2.6    | 3.1    |
| Individual Hydrocarbons  |                 | 59.0                                   | 31.2   | 39.0   | 129.6  | 73.5   | 29.3   | 33.3   | 108.5  |
| Organic Sulfides         |                 | 0.27                                   | 0.02   | 0.04   | 0.00   | --     | --     | --     | --     |
| Organic Amines           |                 | 0.03                                   | 0.03   | 0.04   | 0.37   | 0.05   | 0.02   | 0.05   | 0.10   |
| Other Compounds          |                 |                                        |        |        |        |        |        |        |        |
| Ammonia                  |                 | 87.32                                  | 93.32  | 117.85 | 322.02 | 120.17 | 92.83  | 119.16 | 444.86 |
| Cyanide & Cyanogen       |                 | 1.31                                   | 2.17   | 2.14   | 1.66   | 2.16   | 1.73   | 1.78   | 2.25   |
| DMNA                     |                 | --                                     | --     | --     | --     | --     | --     | --     | --     |
| Hydrogen Sulfide         |                 | 0.07                                   | 0.20   | 0.21   | 0.00   | 0.10   | 0.14   | 0.30   | 0.00   |
| Nickel Carbonyl          |                 | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Nitrous Oxide            |                 | 6.84                                   | 2.51   | 0.65   | 31.52  | 6.87   | 2.66   | 0.65   | 8.35   |
| Sulfur Dioxide           |                 | --                                     | --     | --     | --     | --     | --     | --     | --     |

Table B-25 (Cont'd). Car 23, Fuel No. 1, Initial Mileage

| Test Number,<br>Aldehydes and Ketones       | EMISSION RATE, MG/KM (Except as Noted) |            |            |            |            |            |            |            |
|---------------------------------------------|----------------------------------------|------------|------------|------------|------------|------------|------------|------------|
|                                             | FTP                                    | SET        | HFET       | NYCC       | FTP        | SET        | HFET       | NYCC       |
| Formaldehyde                                | 0.04                                   | 0.01       | 0.02       | 0.00       | 0.30       | 0.00       | 0.00       | 0.00       |
| Acetaldehyde                                | 0.00                                   | 0.00       | 0.00       | 0.00       | 1.09       | 0.29       | 0.89       | 2.39       |
| Acetone                                     | 0.00                                   | 0.00       | 0.00       | 0.00       | 0.09       | 0.19       | 1.68       | 0.00       |
| Isobutyraldehyde                            | 0.00                                   | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       |
| Methyl Ethyl Ketone                         | 0.34                                   | 0.13       | 0.12       | 1.13       | 0.18       | 0.00       | 0.00       | 0.67       |
| Crotonaldehyde                              | --                                     | --         | --         | --         | --         | --         | --         | --         |
| Hexanaldehyde                               | 0.00                                   | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       |
| Benzaldehyde                                | --                                     | --         | --         | --         | --         | --         | --         | --         |
| Aldehydes and Ketones<br>Total as % of THC, | 0.4<br>0.3                             | 0.1<br>0.3 | 0.1<br>0.2 | 1.1<br>1.6 | 1.7<br>1.1 | 0.5<br>1.0 | 2.6<br>5.2 | 3.1<br>2.8 |
| Individual Hydrocarbons                     |                                        |            |            |            |            |            |            |            |
| Methane                                     | 23.21                                  | 13.68      | 15.23      | 71.85      | 24.27      | 11.63      | 11.89      | 64.44      |
| Ethylene                                    | 8.74                                   | 3.78       | 4.55       | 7.82       | 9.44       | 3.22       | 3.80       | 4.43       |
| Ethane                                      | 0.93                                   | 1.40       | 1.55       | 6.58       | 3.09       | 1.53       | 1.67       | 7.15       |
| Acetylene                                   | 1.46                                   | 0.00       | 0.23       | 0.00       | 1.88       | 0.10       | 0.11       | 0.00       |
| Propane                                     | 0.00                                   | 0.00       | 1.28       | 5.99       | 0.00       | 0.43       | 0.84       | 7.69       |
| Propylene                                   | 4.22                                   | 2.46       | 2.63       | 0.87       | 4.66       | 1.86       | 2.49       | 0.00       |
| Benzene                                     | 8.17                                   | 5.58       | 6.85       | 26.17      | 11.96      | 5.14       | 6.31       | 15.04      |
| Toluene                                     | 12.28                                  | 6.31       | 6.70       | 10.33      | 18.23      | 5.36       | 6.19       | 9.74       |
| Total Individual HC                         | 59.0                                   | 33.2       | 39.0       | 129.6      | 73.5       | 29.3       | 33.3       | 108.5      |
| Total as % of THC,                          | 49.2                                   | 83.0       | 78.0       | --         | 49.0       | 58.6       | 66.6       | 98.6       |
| Organic Sulfides                            |                                        |            |            |            |            |            |            |            |
| Carbonyl Sulfide                            | 0.00                                   | 0.02       | 0.04       | 0.00       | --         | --         | --         | --         |
| Methyl Sulfide                              | 0.00                                   | 0.00       | 0.00       | 0.00       | --         | --         | --         | --         |
| Ethyl Sulfide                               | 0.27                                   | 0.00       | 0.00       | 0.00       | --         | --         | --         | --         |
| Methyl Disulfide                            | 0.00                                   | 0.00       | 0.00       | 0.00       | --         | --         | --         | --         |
| Organic Amines                              |                                        |            |            |            |            |            |            |            |
| Monomethylamine                             | 0.01                                   | 0.02       | 0.03       | 0.08       | 0.04       | 0.02       | 0.03       | 0.10       |
| Monomethylamine                             | 0.01                                   | 0.01       | 0.01       | 0.19       | 0.01       | 0.00       | 0.02       | 0.00       |
| Trimethylamine                              | 0.01                                   | 0.00       | 0.00       | 0.10       | 0.00       | 0.00       | 0.00       | 0.00       |
| Diethylamine                                | 0.00                                   | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       |
| Triethylamine                               | 0.00                                   | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       |

Table B-26. Car 23, Fuel No. 2, Initial Mileage

|                          | EMISSION RATE, MG/KM (Except as Noted) |        |        |        |        |        |        |        |
|--------------------------|----------------------------------------|--------|--------|--------|--------|--------|--------|--------|
|                          | FTP                                    | SET    | HFET   | NYCC   | FTP    | SET    | HFET   | NYCC   |
| Test Number, PUMPST      | 230211                                 | 230212 | 230213 | 230214 | 230221 | 230222 | 230223 | 230224 |
| Barometer, mm Hg         | 737.9                                  | 738.4  | 738.4  | 738.4  | 733.6  | 733.8  | 733.8  | 733.8  |
| Humidity, g/kg           | 10.5                                   | 11.0   | 13.8   | 12.7   | 14.1   | 14.4   | 12.3   | 12.3   |
| Temperature, °C          | 22.2                                   | 27.8   | 26.7   | 27.2   | 24.4   | 25.6   | 26.7   | 26.7   |
| Total Fuel Sulfur, mg/km | 25.58                                  | 22.98  | 20.73  | 40.44  | 26.04  | 22.29  | 20.77  | 40.07  |
| Carbon Dioxide, g/km     | 261.5                                  | 234.0  | 209.2  | 413.3  | 264.4  | 227.1  | 211.1  | 408.1  |
| Fuel Cons., l/100 km     | 11.32                                  | 10.17  | 9.18   | 17.90  | 11.53  | 9.87   | 9.19   | 17.74  |
| Regulated Emissions      |                                        |        |        |        |        |        |        |        |
| Hydrocarbons (THC), g/km | 0.11                                   | 0.04   | 0.05   | 0.10   | 0.15   | 0.07   | 0.06   | 0.14   |
| Carbon Monoxide, g/km    | 2.17                                   | 2.66   | 3.60   | 3.73   | 3.31   | 2.48   | 2.62   | 4.47   |
| Oxides of Nitrogen, g/km | 0.09                                   | 0.07   | 0.08   | 0.05   | 0.12   | 0.09   | 0.09   | 0.08   |
| Particulates             |                                        |        |        |        |        |        |        |        |
| Sulfate                  | 0.15                                   | 0.23   | 0.00   | 0.77   | 0.26   | 0.25   | 0.09   | 1.28   |
| Sulfate as % of TFS, %   | 0.20                                   | 0.33   | 0.00   | 0.63   | 0.33   | 0.37   | 0.14   | 1.06   |
| Compound Group Totals    |                                        |        |        |        |        |        |        |        |
| Aldehydes & Ketones      | 0.5                                    | 0.1    | 0.2    | 1.0    | 0.2    | 0.4    | 1.0    | 4.3    |
| Individual Hydrocarbons  | 42.3                                   | 29.1   | 36.0   | 95.6   | 58.2   | 39.8   | 39.4   | 112.4  |
| Organic Sulfides         | 1.62                                   | 0.10   | --     | 2.93   | 0.60   | 0.02   | 0.03   | 0.16   |
| Organic Amines           | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Other Compounds          |                                        |        |        |        |        |        |        |        |
| Ammonia                  | 61.23                                  | 72.90  | 24.07  | 352.72 | 69.72  | 69.64  | 92.61  | 243.46 |
| Cyanide & Cyanogen       | 1.34                                   | 1.07   | 1.96   | 7.15   | 2.38   | 1.08   | 1.13   | 11.37  |
| DMNA                     | --                                     | --     | --     | --     | --     | --     | --     | --     |
| Hydrogen Sulfide         | 0.00                                   | 0.05   | 0.12   | 0.00   | 0.42   | 0.64   | 0.81   | 0.40   |
| Nickel Carbonyl          | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Nitrous Oxide            | 12.24                                  | 2.16   | 1.04   | 13.48  | 14.67  | 4.90   | 2.19   | 56.99  |
| Sulfur Dioxide           | --                                     | --     | --     | --     | --     | --     | --     | --     |

Table B-26 (Cont'd). Car 23, Fuel No. 2, Initial Mileage

| EMISSION RATE, MG/KM (Except as Noted) |        |        |        |        |        |        |        |        |        |
|----------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Test Number, PMWFST                    | FTP    |        | SET    |        | HFET   |        | NYCC   |        | NYCC   |
|                                        | 230211 | 230212 | 230212 | 230213 | 230214 | 230221 | 230222 | 230224 |        |
| Aldehydes and Ketones                  |        |        |        |        |        |        |        |        |        |
| Formaldehyde                           | 0.04   | 0.12   | 0.15   | 1.01   | 0.22   | 0.29   | 0.50   | 4.26   | 230225 |
| Acetaldehyde                           | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Acetone                                | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Isobutyraldehyde                       | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.11   | 0.49   | 0.00   | 0.00   |
| Methyl Ethyl Ketone                    | 0.16   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Crotonaldehyde                         | --     | --     | --     | --     | --     | --     | --     | --     | --     |
| Hexanaldehyde                          | 0.25   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Benzaldehyde                           | --     | --     | --     | --     | --     | --     | --     | --     | --     |
| Aldehydes and Ketones                  | 0.5    | 0.1    | 0.2    | 1.0    | 0.2    | 0.4    | 1.0    | 4.3    | 3.1    |
| Total as % of THC,                     | 0.5    | 0.3    | 0.4    | 1.0    | 0.1    | 0.6    | 1.7    | 3.1    |        |
| Individual Hydrocarbons                |        |        |        |        |        |        |        |        |        |
| Methane                                | 7.99   | 11.00  | 12.83  | 67.09  | 21.53  | 18.92  | 16.60  | 52.71  |        |
| Ethylene                               | 7.68   | 3.39   | 4.36   | 3.58   | 7.42   | 3.88   | 3.96   | 5.70   |        |
| Ethane                                 | 0.44   | 1.28   | 1.48   | 3.61   | 1.99   | 2.05   | 2.00   | 7.79   |        |
| Acetylene                              | 1.36   | 0.26   | 0.19   | 0.00   | 1.59   | 0.52   | 0.38   | 0.00   |        |
| Propane                                | 0.00   | 0.43   | 1.53   | 3.57   | 0.00   | 0.41   | 0.77   | 13.81  |        |
| Propylene                              | 4.03   | 2.31   | 2.61   | 2.20   | 3.77   | 2.03   | 2.57   | 4.61   |        |
| Benzene                                | 9.41   | 5.03   | 6.70   | 13.63  | 9.72   | 6.09   | 7.17   | 20.82  |        |
| Toluene                                | 11.40  | 5.37   | 6.26   | 1.93   | 12.15  | 5.85   | 5.98   | 6.96   |        |
| Total Individual HC                    | 42.3   | 29.1   | 36.0   | 95.6   | 58.2   | 39.8   | 39.4   | 112.4  |        |
| Total as % of THC,                     | 38.5   | 72.8   | 72.0   | 95.6   | 38.8   | 56.9   | 65.7   | 80.3   |        |
| Organic Sulfides                       |        |        |        |        |        |        |        |        |        |
| Carbonyl Sulfide                       | 0.04   | 0.01   | --     | 0.17   | 0.00   | 0.00   | 0.02   | 0.00   |        |
| Methyl Sulfide                         | 0.13   | 0.09   | --     | 1.14   | 0.00   | 0.00   | 0.01   | 0.16   |        |
| Ethyl Sulfide                          | 1.01   | 0.00   | --     | 0.00   | 0.43   | 0.02   | 0.00   | 0.00   |        |
| Methyl Disulfide                       | 0.44   | 0.00   | --     | 1.62   | 0.17   | 0.00   | 0.00   | 0.00   |        |
| Organic Amines                         |        |        |        |        |        |        |        |        |        |
| Monomethylamine                        | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |        |
| Monomethylamine                        | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |        |
| Trimethylamine                         | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |        |
| Diethylamine                           | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |        |
| Triethylamine                          | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |        |

Table B-27. Car 23, Fuel No. 3, Initial Mileage

|                          | EMISSION RATE, MG/KM (Except as Noted) |        |        |        |        |        |        |        |
|--------------------------|----------------------------------------|--------|--------|--------|--------|--------|--------|--------|
|                          | FTP                                    | SET    | HFET   | NYCC   | FTP    | SET    | HFET   | NYCC   |
| Test Number, PVMFST      | 230311                                 | 230312 | 230313 | 230314 | 230321 | 230322 | 230323 | 230324 |
| Barometer, mm Hg         | 742.4                                  | 742.4  | 739.9  | 739.9  | 736.3  | 736.3  | 736.3  | 736.3  |
| Humidity, g/kg           | 8.2                                    | 8.8    | 7.5    | 9.5    | 12.5   | 11.5   | 13.8   | 13.8   |
| Temperature, °C          | 22.8                                   | 22.8   | 24.4   | 24.4   | 24.4   | 25.0   | 26.7   | 26.7   |
| Total Fuel Sulfur, mg/km | 26.82                                  | 22.77  | 21.40  | 41.93  | 25.85  | 22.35  | 21.50  | 40.66  |
| Carbon Dioxide, g/km     | 273.8                                  | 233.0  | 218.9  | 430.9  | 263.9  | 228.7  | 219.2  | 418.4  |
| Fuel Cons., l/100 km     | 11.83                                  | 10.05  | 9.44   | 18.50  | 11.41  | 9.86   | 9.49   | 17.94  |
| Regulated Emissions      |                                        |        |        |        |        |        |        |        |
| Hydrocarbons (THC), g/km | 0.13                                   | 0.04   | 0.04   | 0.07   | 0.11   | 0.03   | 0.03   | 0.02   |
| Carbon Monoxide, g/km    | 1.93                                   | 1.51   | 1.45   | 1.55   | 1.91   | 1.42   | 1.88   | 1.18   |
| Oxides of Nitrogen, g/km | 0.12                                   | 0.09   | 0.08   | 0.06   | 0.11   | 0.09   | 0.09   | 0.21   |
| Particulates             |                                        |        |        |        |        |        |        |        |
| Sulfate                  | 0.06                                   | 0.00   | 0.01   | 0.00   | 0.15   | 0.03   | 0.00   | 0.95   |
| Sulfate as % of TFS, %   | 0.07                                   | 0.00   | 0.02   | 0.00   | 0.19   | 0.04   | 0.00   | 0.78   |
| Compound Group Totals    |                                        |        |        |        |        |        |        |        |
| Aldehydes & Ketones      | 1.5                                    | 0.0    | 0.0    | 3.2    | 1.3    | 0.3    | 0.4    | 0.7    |
| Individual Hydrocarbons  | 49.3                                   | 26.7   | 23.6   | 35.8   | 43.5   | 24.9   | 27.4   | 33.6   |
| Organic Sulfides         | 0.32                                   | 0.04   | 0.08   | 0.25   | 0.50   | 0.08   | 0.11   | 1.86   |
| Organic Amines           | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Other Compounds          |                                        |        |        |        |        |        |        |        |
| Ammonia                  | 59.47                                  | 70.67  | 80.88  | 233.88 | 53.42  | 50.86  | 68.03  | 90.84  |
| Cyanide & Cyanogen       | 2.85                                   | 3.78   | 2.63   | 2.85   | 2.72   | 2.62   | 2.84   | 1.84   |
| DMRA                     | --                                     | --     | --     | --     | --     | --     | --     | --     |
| Hydrogen Sulfide         | 0.19                                   | 0.26   | 0.13   | 0.16   | 0.11   | 0.19   | 0.25   | 0.00   |
| Nickel Carbonyl          | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Nitrous Oxide            | 13.32                                  | 4.82   | 2.78   | 14.43  | 7.65   | 2.91   | 1.90   | 7.52   |
| Sulfur Dioxide           | --                                     | --     | --     | --     | --     | --     | --     | --     |

Table B-27 (Cont'd). Car 23, Fuel No. 3, Initial Mileage

| Test Number,<br>Aldehydes and Ketones       | EMISSION RATE, MG/KM (Excerpt as Noted) |            |            |            |            |            |            |            |
|---------------------------------------------|-----------------------------------------|------------|------------|------------|------------|------------|------------|------------|
|                                             | FTP                                     | SET        | HFET       | NYCC       | FTP        | SET        | HFET       | NYCC       |
| Formaldehyde                                | 0.00                                    | 0.00       | 0.00       | 3.22       | 0.00       | 0.00       | 0.00       | 0.00       |
| Acetaldehyde                                | 1.49                                    | 0.00       | 0.00       | 0.00       | 0.70       | 0.15       | 0.00       | 0.00       |
| Acetone                                     | 0.00                                    | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       |
| Isobutyraldehyde                            | 0.00                                    | 0.00       | 0.00       | 0.00       | 0.77       | 0.18       | 0.35       | 0.72       |
| Methyl Ethyl Ketone                         | 0.00                                    | 0.00       | 0.00       | 0.00       | 0.28       | 0.00       | 0.00       | 0.00       |
| Crotonaldehyde                              | --                                      | --         | --         | --         | --         | --         | --         | --         |
| Benzaldehyde                                | 0.00                                    | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       |
| Benzaldehyde                                | --                                      | --         | --         | --         | --         | --         | --         | --         |
| Aldehydes and Ketones<br>Total as % of THC, | 1.5<br>1.2                              | 0.0<br>0.0 | 0.0<br>0.0 | 3.2<br>4.6 | 1.3<br>1.2 | 0.3<br>1.0 | 0.4<br>1.3 | 0.7<br>3.5 |
| Individual Hydrocarbons                     |                                         |            |            |            |            |            |            |            |
| Methane                                     | 24.03                                   | 13.73      | 12.08      | 32.94      | 19.94      | 12.10      | 14.25      | 30.88      |
| Ethylene                                    | 9.18                                    | 3.62       | 3.90       | 2.20       | 8.29       | 2.93       | 4.08       | 2.71       |
| Ethane                                      | 2.80                                    | 1.90       | 1.55       | 0.00       | 2.52       | 1.71       | 2.05       | 0.00       |
| Acetylene                                   | 2.13                                    | 0.53       | 0.00       | 0.00       | 1.93       | 0.47       | 0.00       | 0.00       |
| Propane                                     | 0.00                                    | 0.51       | 0.00       | 0.00       | 0.00       | 1.67       | 0.92       | 0.00       |
| Propylene                                   | 4.93                                    | 2.37       | 2.57       | 0.00       | 5.00       | 2.20       | 2.86       | 0.00       |
| Benzene                                     | 3.62                                    | 3.41       | 2.33       | 0.10       | 3.64       | 2.43       | 2.68       | 0.05       |
| Toluene                                     | 2.58                                    | 0.64       | 1.13       | 0.52       | 2.14       | 1.37       | 0.57       | 0.00       |
| Total Individual HC                         | 49.3                                    | 26.7       | 23.6       | 35.8       | 43.5       | 24.9       | 27.4       | 33.6       |
| Total as % of THC,                          | 37.9                                    | 66.8       | 59.0       | 51.1       | 39.6       | 83.0       | 91.3       | --         |
| Organic Sulfides                            |                                         |            |            |            |            |            |            |            |
| Carbonyl Sulfide                            | 0.01                                    | 0.01       | 0.03       | 0.00       | 0.16       | 0.01       | 0.04       | 0.90       |
| Methyl Sulfide                              | 0.04                                    | 0.02       | 0.00       | 0.25       | 0.01       | 0.02       | 0.06       | 0.46       |
| Ethyl Sulfide                               | 0.17                                    | 0.00       | 0.03       | 0.00       | 0.11       | 0.05       | 0.01       | 0.00       |
| Methyl Disulfide                            | 0.10                                    | 0.01       | 0.02       | 0.00       | 0.22       | 0.00       | 0.00       | 0.50       |
| Organic Amines                              |                                         |            |            |            |            |            |            |            |
| Monomethylamine                             | 0.00                                    | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       |
| Dimethylamine                               | 0.00                                    | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       |
| Trimethylamine                              | 0.00                                    | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       |
| Diethylamine                                | 0.00                                    | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       |
| Triethylamine                               | 0.00                                    | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       | 0.00       |

Table P-29 , Car 23, Fuel No. 1, 5000 Miles

|                              | EMISSION RATE, MG/KM (Except as Noted) |        |        |        |        |        |        |        |
|------------------------------|----------------------------------------|--------|--------|--------|--------|--------|--------|--------|
|                              | FTP                                    | SET    | HFET   | HWCC   | FTP    | SET    | HFET   | HWCC   |
| Test Number, AVMPST          | 231111                                 | 231112 | 231113 | 231114 | 231121 | 231122 | 231123 | 231124 |
| Barometer, mm Hg             | 741.4                                  | 741.4  | 741.4  | 741.4  | 743.2  | 742.4  | 742.4  | 742.4  |
| Humidity, g/kg               | 12.6                                   | 11.1   | 7.5    | 9.3    | 11.8   | 10.6   | 11.1   | 11.0   |
| Temperature, °C              | 22.2                                   | 22.2   | 24.4   | 23.3   | 23.9   | 25.0   | 25.6   | 25.6   |
| Total Fuel Sulfur, mg/km     | 0.85                                   | 0.70   | 0.66   | 1.39   | 0.85   | 0.71   | 0.68   | 1.41   |
| Carbon Dioxide, g/km         | 261.5                                  | 216.6  | 205.9  | 430.6  | 263.3  | 220.4  | 209.8  | 436.7  |
| Fuel Consumption, l/100 km   | 11.28                                  | 9.27   | 8.82   | 18.48  | 11.34  | 9.44   | 8.98   | 18.71  |
| <u>Regulated Emissions</u>   |                                        |        |        |        |        |        |        |        |
| Hydrocarbons (THC), g/km     | 0.12                                   | 0.01   | 0.01   | 0.04   | 0.09   | 0.01   | 0.01   | 0.04   |
| Carbon Monoxide, g/km        | 1.45                                   | 0.44   | 0.41   | 1.14   | 1.32   | 0.40   | 0.40   | 0.99   |
| Oxides of Nitrogen, g/km     | 0.23                                   | 0.20   | 0.17   | 0.12   | 0.29   | 0.23   | 0.25   | 0.33   |
| <u>Particulates</u>          |                                        |        |        |        |        |        |        |        |
| Sulfate                      | 0.11                                   | 0.08   | 0.02   | 0.16   | 0.10   | 0.05   | 0.02   | 0.16   |
| Sulfate as % of TFS, %       | 4.31                                   | 3.81   | 1.01   | 3.84   | 3.92   | 2.35   | 0.98   | 3.78   |
| <u>Compound Group Totals</u> |                                        |        |        |        |        |        |        |        |
| Aldehydes & Ketones          | 0.7                                    | 0.0    | 3.3    | 11.1   | 4.9    | 0.7    | 0.4    | 8.0    |
| Individual Hydrocarbons      | 53.8                                   | 12.0   | 11.3   | 62.4   | 43.0   | 8.1    | 6.0    | 55.9   |
| Organic Sulfides             | 0.07                                   | 0.09   | 0.07   | 0.05   | 0.06   | 0.11   | 0.02   | 0.00   |
| Organic Amines               | 0.03                                   | 0.00   | 0.02   | 0.23   | 0.09   | 0.02   | 0.00   | 0.07   |
| <u>Other Compounds</u>       |                                        |        |        |        |        |        |        |        |
| Ammonia                      | 4.20                                   | 1.37   | 0.00   | 14.05  | 4.67   | 1.97   | 1.80   | 15.23  |
| Cyanide & Cyanogen           | 1.06                                   | 0.04   | 0.82   | 2.09   | 1.40   | 0.24   | 1.40   | 2.00   |
| IPA                          | --                                     | --     | --     | --     | --     | --     | --     | --     |
| Hydrogen Sulfide             | 0.00                                   | 0.00   | 0.00   | 0.09   | 0.00   | 0.00   | 0.00   | 0.00   |
| Nickel Carbonyl              | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Nitrous Oxide                | 15.83                                  | 7.33   | 5.75   | 13.77  | 9.64   | 5.65   | 4.50   | 19.50  |
| Sulfur Dioxide               | --                                     | --     | --     | --     | --     | --     | --     | --     |

BOTTOM OF IMAGE AREA  
OUTSIDE DIMENSION FOR TABLES AND ILLUSTRATIONS



Table B-28 (Cont'd). Car 23, Fuel No. 1, 5000 Miles  
EMISSION RATE, MG/EM (Except as Noted)

| Test Number,<br>Aldehydes and Ketones       | EMISSION RATE, MG/EM (Except as Noted) |            |             |              |            |            |
|---------------------------------------------|----------------------------------------|------------|-------------|--------------|------------|------------|
|                                             | FTP                                    | SET        | HFET        | NYCC         | FTP        | SET        |
| Formaldehyde                                | 0.01                                   | 0.00       | 0.00        | 0.00         | 0.48       | 0.32       |
| Acetaldehyde                                | 0.00                                   | 0.00       | 0.00        | 0.00         | 0.00       | 0.00       |
| Acetone                                     | 0.00                                   | 0.00       | 0.00        | 0.00         | 0.00       | 0.00       |
| Isobutyraldehyde                            | 0.67                                   | 0.00       | 3.27        | 11.06        | 4.36       | 0.39       |
| Methyl Ethyl Ketone                         | 0.00                                   | 0.00       | 0.00        | 0.00         | 0.00       | 0.00       |
| Crotonaldehyde                              | --                                     | --         | --          | --           | --         | --         |
| Hexanaldehyde                               | 0.00                                   | 0.00       | 0.00        | 0.00         | 0.06       | 0.00       |
| Benzaldehyde                                | --                                     | --         | --          | --           | --         | --         |
| Aldehydes and Ketones<br>Total as % of THC, | 0.7<br>0.6                             | 0.0<br>0.0 | 3.3<br>33.0 | 11.1<br>27.8 | 4.9<br>5.4 | 0.7<br>7.0 |
| Individual Hydrocarbons                     |                                        |            |             |              |            |            |
| Methane                                     | 16.12                                  | 4.19       | 2.36        | 28.61        | 12.12      | 2.61       |
| Ethylene                                    | 8.45                                   | 1.66       | 1.65        | 0.81         | 8.25       | 1.51       |
| Ethane                                      | 2.36                                   | 0.56       | 0.41        | 3.25         | 0.52       | 0.57       |
| Acetylene                                   | 2.46                                   | 0.10       | 0.11        | 0.00         | 2.24       | 0.26       |
| Propane                                     | 0.22                                   | 0.13       | 1.45        | 17.53        | 0.00       | 0.60       |
| Propylene                                   | 4.22                                   | 1.56       | 1.30        | 2.47         | 4.59       | 1.32       |
| Benzene                                     | 7.99                                   | 1.95       | 2.44        | 6.65         | 5.89       | 1.27       |
| Toluene                                     | 12.02                                  | 1.84       | 1.57        | 3.10         | 9.37       | 0.00       |
| Total Individual HC                         | 53.8                                   | 12.0       | 11.3        | 62.4         | 43.0       | 8.1        |
| Total as % of THC,                          | 44.8                                   | --         | --          | --           | 47.8       | 81.0       |
| Organic Sulfides                            |                                        |            |             |              |            |            |
| Carbonyl Sulfide                            | 0.04                                   | 0.06       | 0.05        | 0.05         | 0.04       | 0.07       |
| Methyl Sulfide                              | 0.01                                   | 0.03       | 0.02        | 0.00         | 0.02       | 0.04       |
| Ethyl Sulfide                               | 0.02                                   | 0.00       | 0.00        | 0.00         | 0.00       | 0.00       |
| Methyl Disulfide                            | 0.00                                   | 0.00       | 0.00        | 0.00         | 0.00       | 0.00       |
| Organic Amines                              |                                        |            |             |              |            |            |
| Monomethylamine                             | 0.01                                   | 0.00       | 0.01        | 0.10         | 0.00       | 0.01       |
| Dimethylamine                               | 0.02                                   | 0.00       | 0.01        | 0.13         | 0.00       | 0.00       |
| Trimethylamine                              | 0.00                                   | 0.00       | 0.00        | 0.00         | 0.00       | 0.01       |
| Diethylamine                                | 0.00                                   | 0.00       | 0.00        | 0.00         | 0.00       | 0.00       |
| Triethylamine                               | 0.00                                   | 0.00       | 0.00        | 0.00         | 0.00       | 0.00       |

Table B-29. Car 23, Fuel No. 2, 5000 Miles

|                              | EMISSION RATE, MG/KM (Except as Noted) |        |        |        |        |        |        |        |
|------------------------------|----------------------------------------|--------|--------|--------|--------|--------|--------|--------|
|                              | FTP                                    | SET    | HFET   | MYCC   | FTP    | SET    | HFET   | MYCC   |
| <b>Test Results,</b>         |                                        |        |        |        |        |        |        |        |
| Barometer,                   | 231211                                 | 231212 | 231213 | 231214 | 231221 | 231222 | 231223 | 231224 |
| Humidity,                    | 744.7                                  | 745.0  | 744.7  | 744.7  | 745.5  | 745.5  | 745.5  | 745.5  |
| Temperature,                 | 11.3                                   | 11.1   | 9.2    | 7.8    | 11.8   | 12.0   | 11.3   | 9.6    |
|                              | 23.3                                   | 23.9   | 25.0   | 25.0   | 23.9   | 23.3   | 25.0   | 25.6   |
| Total Fuel Sulfur, mg/km     | 25.65                                  | 21.38  | 19.80  | 41.61  | 26.76  | 22.01  | 20.59  | 40.80  |
| Carbon Dioxide, g/km         | 263.3                                  | 221.0  | 204.8  | 429.7  | 274.6  | 227.6  | 212.7  | 421.1  |
| Fuel Cons., l/100 km         | 11.35                                  | 9.46   | 8.77   | 18.42  | 11.84  | 9.74   | 9.12   | 18.06  |
| <b>Regulated Emissions</b>   |                                        |        |        |        |        |        |        |        |
| Hydrocarbons (THC), g/km     | 0.13                                   | 0.01   | 0.02   | 0.03   | 0.09   | 0.01   | 0.02   | 0.03   |
| Carbon Monoxide, g/km        | 1.48                                   | 0.42   | 0.34   | 1.09   | 1.68   | 0.41   | 0.51   | 1.27   |
| Oxides of Nitrogen, g/km     | 0.32                                   | 0.28   | 0.32   | 0.34   | 0.38   | 0.54   | 0.25   | 0.41   |
| <b>Particulates</b>          |                                        |        |        |        |        |        |        |        |
| Sulfate                      | 0.54                                   | 0.05   | 0.14   | 0.39   | 0.11   | 0.00   | 0.07   | 0.65   |
| Sulfate as % of TFS, %       | 0.70                                   | 0.08   | 0.24   | 0.31   | 0.14   | 0.00   | 0.11   | 0.53   |
| <b>Compound Group Totals</b> |                                        |        |        |        |        |        |        |        |
| Aldehydes & Ketones          | 1.7                                    | 2.0    | 1.4    | 10.2   | 1.9    | 0.2    | 1.9    | 11.2   |
| Individual Hydrocarbons      | 51.7                                   | 10.9   | 8.7    | 54.9   | 62.3   | 14.4   | 15.6   | 44.6   |
| Organic Sulfides             | 0.24                                   | 0.19   | 0.16   | 1.59   | 0.24   | 0.20   | 0.05   | 1.06   |
| Organic Amines               | 0.04                                   | 0.00   | 0.00   | 0.00   | 0.06   | 0.03   | 0.00   | 0.02   |
| <b>Other Compounds</b>       |                                        |        |        |        |        |        |        |        |
| Ammonia                      | 4.64                                   | 2.82   | 2.11   | 22.76  | 3.57   | 0.40   | 1.40   | 17.82  |
| Cyanide & Cyanogen           | 1.31                                   | 0.51   | 0.67   | 1.19   | 1.14   | 0.09   | 0.10   | 3.27   |
| IPA                          | --                                     | --     | --     | --     | --     | --     | --     | --     |
| Hydrogen Sulfide             | 0.10                                   | 0.08   | 0.03   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Nickel Carbonyl              | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Nitrous Oxide                | --                                     | 10.55  | 7.81   | 50.70  | 21.52  | 21.69  | 8.76   | 40.23  |
| Sulfur Dioxide               | --                                     | --     | --     | --     | --     | --     | --     | --     |

Table B-29 (Cont'd). Car 23, Fuel No. 2, 5000 Miles

| Test Number, PMFST      | EMISSION RATE, MG/KM (Except as Noted) |        |        |        |        |        |
|-------------------------|----------------------------------------|--------|--------|--------|--------|--------|
|                         | FTP                                    | SET    | HFET   | NYCC   | FTP    | SET    |
|                         | 231211                                 | 231212 | 231213 | 231214 | 231221 | 231222 |
| Aldehydes and Ketones   |                                        |        |        |        |        |        |
| Formaldehyde            | 0.72                                   | 0.79   | 0.68   | 4.32   | 0.48   | 0.07   |
| Acetaldehyde            | 0.40                                   | 0.58   | 0.64   | 2.37   | 0.36   | 0.09   |
| Acetone                 | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Isobutyraldehyde        | 0.54                                   | 0.60   | 0.04   | 2.63   | 1.09   | 0.00   |
| Methyl Ethyl Ketone     | 0.00                                   | 0.67   | 0.00   | 0.00   | 0.00   | 0.00   |
| Crotonaldehyde          | --                                     | --     | --     | --     | --     | --     |
| Hexanaldehyde           | 0.00                                   | 0.00   | 0.00   | 0.87   | 0.00   | 0.00   |
| Benzaldehyde            | --                                     | --     | --     | --     | --     | --     |
| Aldehydes and Ketones   | 1.7                                    | 2.0    | 1.4    | 10.2   | 1.9    | 0.2    |
| Total as % of THC, %    | 1.1                                    | 20.0   | 7.0    | 34.0   | 2.1    | 2.0    |
| Individual Hydrocarbons |                                        |        |        |        |        |        |
| Methane                 | 17.63                                  | 5.52   | 3.23   | 42.19  | 18.45  | 7.45   |
| Ethylene                | 7.97                                   | 1.73   | 1.86   | 1.40   | 8.77   | 1.82   |
| Ethane                  | 6.99                                   | 0.43   | 0.34   | 2.67   | 2.33   | 0.69   |
| Acetylene               | 2.13                                   | 0.10   | 0.19   | 0.00   | 2.57   | 0.26   |
| Propane                 | 0.00                                   | 0.12   | 0.00   | 5.88   | 0.60   | 0.25   |
| Propylene               | 3.86                                   | 0.64   | 1.38   | 2.24   | 4.39   | 1.35   |
| Benzene                 | 5.87                                   | 1.19   | 1.65   | 0.32   | 9.47   | 1.44   |
| Toluene                 | 7.23                                   | 0.97   | 0.00   | 0.16   | 15.70  | 1.13   |
| Total Individual HC     | 51.7                                   | 10.9   | 8.7    | 54.9   | 62.3   | 14.4   |
| Total as % of THC, %    | 39.8                                   | --     | 43.5   | --     | 69.2   | --     |
| Organic Sulfides        |                                        |        |        |        |        |        |
| Carbonyl Sulfide        | 0.15                                   | 0.04   | 0.03   | 1.54   | 0.03   | 0.07   |
| Methyl Sulfide          | 0.06                                   | 0.11   | 0.05   | 0.05   | 0.02   | 0.07   |
| Ethyl Sulfide           | 0.02                                   | 0.04   | 0.01   | 0.00   | 0.18   | 0.06   |
| Methyl Disulfide        | 0.01                                   | 0.00   | 0.07   | 0.00   | 0.01   | 0.00   |
| Organic Amines          |                                        |        |        |        |        |        |
| Monomethylamine         | 0.02                                   | 0.00   | 0.00   | 0.00   | 0.01   | 0.00   |
| Dimethylamine           | 0.02                                   | 0.00   | 0.00   | 0.00   | 0.05   | 0.02   |
| Trimethylamine          | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.01   |
| Diethylamine            | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Triethylamine           | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |

Table B-30. Car 23, Fuel No. 3, 5000 Miles

| EMISSION RATE, MG/KM (Except as Noted)                                                                        |        |        |        |        |        |        |        |        |  |
|---------------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--|
| Test Number,<br>PWPFST<br>mm Hg<br>Barometer,<br>q/kg<br>Humidity,<br>°C<br>Temperature,                      | FTP    | NYCC   |        |        |        | HFET   |        |        |  |
|                                                                                                               |        | SET    | HFET   | NYCC   | FTP    | SET    | HFET   | NYCC   |  |
| Total Fuel Sulfur, mg/km<br>Carbon Dioxide, q/km<br>Fuel Cons., l/100 km                                      | 231311 | 231312 | 231313 | 231314 | 231321 | 231322 | 231323 | 231324 |  |
|                                                                                                               | 745.7  | 746.3  | 746.3  | 746.3  | 744.7  | 744.7  | 744.7  | 744.7  |  |
|                                                                                                               | 11.0   | 11.0   | 10.6   | 11.3   | 12.0   | 10.1   | 13.1   | 13.1   |  |
|                                                                                                               | 23.9   | 23.9   | 25.0   | 25.0   | 23.3   | 24.4   | 26.1   | 26.1   |  |
| Regulated Emissions<br>Hydrocarbons (THC), q/km<br>Carbon Monoxide, q/km<br>Oxides of Nitrogen, q/km          | 24.65  | 20.62  | 18.90  | 40.49  | 24.50  | 20.56  | 19.49  | 40.51  |  |
|                                                                                                               | 252.8  | 212.5  | 195.0  | 415.9  | 250.7  | 212.0  | 201.1  | 417.1  |  |
|                                                                                                               | 10.88  | 9.10   | 8.34   | 17.87  | 10.81  | 9.07   | 8.60   | 17.87  |  |
|                                                                                                               |        |        |        |        |        |        |        |        |  |
| Particulates<br>Sulfate<br>Sulfate as % of TFS, %                                                             | 0.07   | 0.01   | 0.01   | 0.03   | 0.12   | 0.03   | 0.03   | 0.10   |  |
|                                                                                                               | 1.14   | 0.42   | 0.25   | 1.65   | 1.43   | 0.32   | 0.22   | 0.85   |  |
|                                                                                                               | 0.38   | 0.44   | 0.40   | 0.35   | 0.51   | 0.56   | 0.65   | 0.52   |  |
|                                                                                                               |        |        |        |        |        |        |        |        |  |
| Compound Group Totals<br>Aldehydes & Ketones<br>Individual Hydrocarbons<br>Organic Sulfides<br>Organic Amines | 0.14   | 0.06   | 0.08   | 0.04   | 0.19   | 0.07   | 0.06   | 0.30   |  |
|                                                                                                               | 0.19   | 0.10   | 0.14   | 0.03   | 0.26   | 0.11   | 0.10   | 0.25   |  |
|                                                                                                               |        |        |        |        |        |        |        |        |  |
|                                                                                                               |        |        |        |        |        |        |        |        |  |
| Other Compounds<br>Ammonia<br>Cyanide & Cyanogen<br>DMAP                                                      | 0.2    | 0.2    | 0.2    | 9.1    | 0.6    | 0.1    | 0.5    | 7.5    |  |
|                                                                                                               | 38.8   | 12.8   | 9.7    | 73.9   | 48.2   | 12.9   | 6.8    | 24.0   |  |
|                                                                                                               | 0.20   | 0.13   | 0.04   | 0.12   | 0.07   | 0.08   | 0.04   | 0.30   |  |
|                                                                                                               | 0.07   | 0.07   | 0.00   | 0.45   | 0.17   | 0.04   | 0.01   | 0.07   |  |
| Hydrogen Sulfide<br>Nickel Carbonyl<br>Nitrous Oxide<br>Sulfur Dioxide                                        | 0.63   | 1.13   | 1.46   | 12.49  | 1.91   | 0.90   | 1.78   | 10.77  |  |
|                                                                                                               | 1.20   | 0.09   | 0.50   | 1.64   | 1.35   | 0.02   | 0.51   | 1.28   |  |
|                                                                                                               | --     | --     | --     | --     | --     | --     | --     | --     |  |
|                                                                                                               |        |        |        |        |        |        |        |        |  |
| Hydrogen Sulfide<br>Nickel Carbonyl<br>Nitrous Oxide<br>Sulfur Dioxide                                        | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |  |
|                                                                                                               | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |  |
|                                                                                                               | 11.18  | 12.15  | 9.02   | 40.49  | 10.81  | 7.71   | 7.27   | 17.17  |  |
|                                                                                                               | --     | --     | --     | --     | --     | --     | --     | --     |  |

Table B-30 (Cont'd). Car 23, Fuel No. 3, 5000 Miles

|                         |        | EMISSION RATE, MG/KM (Except as Noted) |        |        |        |        |        |
|-------------------------|--------|----------------------------------------|--------|--------|--------|--------|--------|
|                         |        | FTP                                    | SET    | HFET   | NYCC   | FTP    | SET    |
| Test Number,            | FVNFST | 231311                                 | 231312 | 231313 | 231314 | 231321 | 231322 |
| Aldehydes and Ketones   |        |                                        |        |        |        |        |        |
| Formaldehyde            |        | 0.00                                   | 0.00   | 0.00   | 2.40   | 0.46   | 0.11   |
| Acetaldehyde            |        | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.06   | 0.00   |
| Acetone                 |        | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Isobutyraldehyde        |        | 0.16                                   | 0.17   | 0.17   | 6.67   | 0.08   | 0.00   |
| Methyl Ethyl Ketone     |        | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Crotonaldehyde          |        | --                                     | --     | --     | --     | --     | --     |
| Hexanaldehyde           |        | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Benzaldehyde            |        | --                                     | --     | --     | --     | --     | --     |
| Aldehydes and Ketones   |        | 0.2                                    | 0.2    | 0.2    | 9.1    | 0.6    | 0.1    |
| Total as % of THC,      | %      | 0.3                                    | 2.0    | 2.0    | 30.3   | 0.5    | 0.3    |
| Individual Hydrocarbons |        |                                        |        |        |        |        |        |
| Methane                 |        | 17.45                                  | 7.31   | 3.63   | 51.71  | 22.10  | 6.44   |
| Ethylene                |        | 7.78                                   | 2.08   | 1.91   | 3.25   | 9.26   | 2.08   |
| Ethane                  |        | 2.10                                   | 0.74   | 0.50   | 4.21   | 2.87   | 0.78   |
| Acetylene               |        | 1.99                                   | 0.05   | 0.19   | 0.00   | 2.70   | 0.16   |
| Propane                 |        | 0.58                                   | 0.04   | 1.79   | 13.16  | 0.44   | 0.97   |
| Propylene               |        | 4.13                                   | 1.86   | 0.20   | 0.54   | 4.79   | 1.46   |
| Benzene                 |        | 2.38                                   | 0.71   | 1.23   | 1.07   | 3.03   | 0.89   |
| Toluene                 |        | 2.38                                   | 0.03   | 0.21   | 0.00   | 3.05   | 0.16   |
| Total Individual HC     |        | 38.8                                   | 12.8   | 9.7    | 73.9   | 48.2   | 12.9   |
| Total as % of THC,      | %      | 55.4                                   | --     | 97.0   | --     | 40.2   | 43.0   |
| Organic Sulfides        |        |                                        |        |        |        |        |        |
| Carbonyl Sulfide        |        | 0.03                                   | 0.04   | 0.01   | 0.00   | 0.02   | 0.03   |
| Methyl Sulfide          |        | 0.10                                   | 0.06   | 0.02   | 0.00   | 0.01   | 0.04   |
| Ethyl Sulfide           |        | 0.06                                   | 0.03   | 0.01   | 0.12   | 0.03   | 0.01   |
| Methyl Disulfide        |        | 0.01                                   | 0.03   | 0.00   | 0.00   | 0.01   | 0.00   |
| Organic Amines          |        |                                        |        |        |        |        |        |
| Monomethylamine         |        | 0.04                                   | 0.02   | 0.00   | 0.00   | 0.06   | 0.00   |
| Dimethylamine           |        | 0.03                                   | 0.05   | 0.00   | 0.45   | 0.06   | 0.04   |
| Trimethylamine          |        | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.05   | 0.00   |
| Diethylamine            |        | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Triethylamine           |        | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |

Table B-31. CAR 23, FUEL NO. 1, 10,000 MILES

|  |  | EMISSION RATE, MG/KM (Except as Noted) |  |     |  |      |  |      |  |
|--|--|----------------------------------------|--|-----|--|------|--|------|--|
|  |  | FTP                                    |  | SET |  | HFET |  | NYCC |  |
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Table B-31 (Cont'd), CAR 23, FUEL NO. 1, 10,000 MILES

| Test Number, PVMFST     | EMISSION RATE, MG/KM (Except as Noted) |        |        |        |        |        |
|-------------------------|----------------------------------------|--------|--------|--------|--------|--------|
|                         | FTP                                    | SET    | HFET   | NYCC   | FTP    | SET    |
| Aldehydes and Ketones   | 232111                                 | 232112 | 232113 | 232114 | 232121 | 232122 |
| Formaldehyde            | 0.15                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Acetaldehyde            | 0.38                                   | 0.00   | 0.04   | 2.36   | 0.53   | 0.23   |
| Acetone                 | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Isobutyraldehyde        | 2.98                                   | 1.65   | 4.60   | 25.52  | 0.00   | 0.00   |
| Methyl Ethyl Ketone     | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Crotonaldehyde          | --                                     | --     | --     | --     | --     | --     |
| Hexanaldehyde           | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.50   | 0.20   |
| Benzaldehyde            | --                                     | --     | --     | --     | --     | --     |
| Aldehydes and Ketones   | 3.5                                    | 1.7    | 4.6    | 27.9   | 1.0    | 0.4    |
| Total as % of THC,      | 2.3                                    | 8.5    | 15.3   | 31.0   | 0.6    | 2.0    |
| Individual Hydrocarbons |                                        |        |        |        |        |        |
| Methane                 | 20.39                                  | 7.07   | 3.77   | 46.58  | 21.42  | 5.92   |
| Ethylene                | 9.90                                   | 1.66   | 1.65   | 0.57   | 10.91  | 1.45   |
| Ethane                  | 3.28                                   | 0.99   | 1.10   | 2.86   | 2.26   | 0.53   |
| Acetylene               | 2.14                                   | 0.00   | 0.08   | 0.00   | 2.56   | 0.10   |
| Propane                 | 0.65                                   | 0.37   | 2.53   | 0.00   | 0.00   | 0.00   |
| Propylene               | 5.00                                   | 0.55   | 1.11   | 0.00   | 5.25   | 0.28   |
| Benzene                 | 9.37                                   | 2.22   | 2.20   | 1.89   | 11.86  | 1.58   |
| Toluene                 | 11.85                                  | 1.25   | 1.35   | 0.00   | 18.80  | 1.41   |
| Total Individual HC     | 62.6                                   | 14.1   | 13.8   | 51.9   | 73.1   | 11.3   |
| Total as % of THC,      | 41.7                                   | 70.5   | 46.0   | 57.7   | 40.6   | 56.5   |
| Organic Sulfides        |                                        |        |        |        |        |        |
| Carbonyl Sulfide        | 0.03                                   | 0.08   | 0.00   | 0.72   | 0.00   | 0.00   |
| Methyl Sulfide          | 0.04                                   | 0.04   | 0.00   | 0.00   | 0.00   | 0.00   |
| Ethyl Sulfide           | 0.21                                   | 0.01   | 0.00   | 0.00   | 0.00   | 0.00   |
| Methyl Disulfide        | 0.03                                   | 0.01   | 0.00   | 0.05   | 0.00   | 0.00   |
| Organic Amines          |                                        |        |        |        |        |        |
| Monomethylamine         | 0.03                                   | 0.00   | 0.00   | 0.00   | 0.03   | 0.00   |
| Dimethylamine           | 0.02                                   | 0.03   | 0.09   | 0.34   | 0.03   | 0.02   |
| Trimethylamine          | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Diethylamine            | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Triethylamine           | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |



Table B-32. Car 23, Fuel No. 2, 10,000 Miles

EMISSION RATE, MG/KM (Except as Noted)

| Test Number,<br>Barometer,<br>Humidity,<br>Temperature,<br>Total Fuel Sulfur, mg/km<br>Carbon Dioxide, g/km<br>Fuel Cons., l/100 km<br>Regulated Emissions<br>Hydrocarbons (THC), g/km<br>Carbon Monoxide, g/km<br>Oxides of Nitrogen, g/km<br>Particulates<br>Sulfate<br>Sulfate as % of TFS, %<br>Compound Group Totals<br>Aldehydes & Ketones<br>Individual Hydrocarbons<br>Organic Sulfides<br>Organic Amines<br>Other Compounds<br>Ammonia<br>Cyanide & Cyanogen<br>DMNA<br>Hydrogen Sulfide<br>Nickel Carbonyl<br>Nitrous Oxide<br>Sulfur Dioxide | FTP | SET    |        |        | HFET | NYCC   |        |        | FTP | SET    |        |        | HFET | NYCC   |        |        |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|--------|--------|--------|------|--------|--------|--------|-----|--------|--------|--------|------|--------|--------|--------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |     | 232211 | 232212 | 232213 |      | 232214 | 232215 | 232216 |     | 232221 | 232222 | 232223 |      | 232224 | 232225 | 232226 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |     | 741.2  | 741.2  | 741.2  |      | 741.2  | 741.2  | 741.2  |     | 739.1  | 740.7  | 739.6  |      | 739.6  | 739.6  | 739.6  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |     | 9.8    | 9.7    | 10.2   |      | 8.0    | 8.0    | 8.0    |     | 10.5   | 10.9   | 10.9   |      | 12.2   | 12.2   | 12.2   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |     | 22.2   | 25.6   | 26.1   |      | 31.1   | 31.1   | 31.1   |     | 23.9   | 26.1   | 27.8   |      | 26.7   | 26.7   | 26.7   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |     | 26.26  | 22.01  | 20.24  |      | 42.05  | 42.05  | 42.05  |     | 25.58  | 20.97  | 19.20  |      | 41.04  | 41.04  | 41.04  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |     | 268.6  | 227.2  | 209.4  |      | 429.9  | 429.9  | 429.9  |     | 261.2  | 216.3  | 198.5  |      | 419.7  | 419.7  | 419.7  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |     | 11.62  | 9.75   | 8.96   |      | 18.61  | 18.61  | 18.61  |     | 11.32  | 9.28   | 8.50   |      | 18.17  | 18.17  | 18.17  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |     | 0.14   | 0.02   | 0.02   |      | 0.08   | 0.08   | 0.08   |     | 0.18   | 0.03   | 0.01   |      | 0.05   | 0.05   | 0.05   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |     | 2.09   | 0.70   | 0.30   |      | 3.79   | 3.79   | 3.79   |     | 2.28   | 0.67   | 0.38   |      | 3.66   | 3.66   | 3.66   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |     | 0.56   | 0.72   | 0.76   |      | 0.56   | 0.56   | 0.56   |     | 0.51   | 0.56   | 0.66   |      | 0.62   | 0.62   | 0.62   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |     | 0.05   | 0.03   | 0.01   |      | 0.09   | 0.09   | 0.09   |     | 0.10   | --     | 0.03   |      | 0.10   | 0.10   | 0.10   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |     | 0.06   | 0.05   | 0.02   |      | 0.07   | 0.07   | 0.07   |     | 0.13   | --     | 0.05   |      | 0.08   | 0.08   | 0.08   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |     | 5.9    | 0.1    | 0.9    |      | 37.6   | 37.6   | 37.6   |     | 1.7    | --     | 5.8    |      | 22.8   | 22.8   | 22.8   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |     | 64.7   | 14.2   | 12.3   |      | 61.6   | 61.6   | 61.6   |     | 88.9   | 13.3   | 15.0   |      | 86.5   | 86.5   | 86.5   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |     | 0.07   | 0.03   | 0.10   |      | 0.00   | 0.00   | 0.00   |     | 0.05   | --     | 0.00   |      | 0.00   | 0.00   | 0.00   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |     | 0.01   | 0.00   | 0.05   |      | 0.04   | 0.04   | 0.04   |     | 0.03   | --     | 0.04   |      | 0.11   | 0.11   | 0.11   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |     | 4.13   | 2.76   | 1.64   |      | 10.30  | 10.30  | 10.30  |     | 2.54   | --     | 1.23   |      | 9.56   | 9.56   | 9.56   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |     | 1.63   | 0.89   | 0.69   |      | 3.48   | 3.48   | 3.48   |     | 1.69   | --     | 0.88   |      | 2.91   | 2.91   | 2.91   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |     | --     | --     | --     |      | --     | --     | --     |     | --     | --     | --     |      | --     | --     | --     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |     | 0.00   | 0.00   | 0.00   |      | 0.00   | 0.00   | 0.00   |     | 0.00   | --     | 0.00   |      | 0.00   | 0.00   | 0.00   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |     | 0.00   | 0.00   | 0.00   |      | 0.00   | 0.00   | 0.00   |     | 0.00   | --     | 0.00   |      | 0.00   | 0.00   | 0.00   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |     | 18.03  | 11.53  | 11.39  |      | 46.12  | 46.12  | 46.12  |     | 16.10  | 11.32  | 10.90  |      | 42.12  | 42.12  | 42.12  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |     | 24.97  | 32.58  | 32.23  |      | 57.44  | 57.44  | 57.44  |     | 37.19  | --     | 17.64  |      | 24.86  | 24.86  | 24.86  |

Table B-32 (Cont'd). Car 23, Fuel No. 2, 10,000 Miles

| Test Number,<br>Aldehydes and Ketones       | PMNFT      | EMISSION RATE, MG/KM (Except as Noted) |            |            |              |            |      |
|---------------------------------------------|------------|----------------------------------------|------------|------------|--------------|------------|------|
|                                             |            | FTP                                    | SET        | HFET       | NYCC         | FTP        | SET  |
| Formaldehyde                                | 232211     | 0.00                                   | 0.00       | 0.00       | 0.00         | 0.07       | --   |
| Acetaldehyde                                | 0.05       | 0.00                                   | 0.00       | 0.00       | 0.00         | 0.07       | --   |
| Acetone                                     | 0.00       | 0.00                                   | 0.00       | 0.00       | 0.00         | 1.53       | --   |
| Isobutyraldehyde                            | 5.91       | 0.05                                   | 0.05       | 0.54       | 33.39        | 0.00       | --   |
| Methyl Ethyl Ketone                         | 0.00       | 0.00                                   | 0.00       | 0.00       | 0.00         | 0.00       | --   |
| Crotonaldehyde                              | --         | --                                     | --         | --         | --           | --         | --   |
| Hexanaldehyde                               | 0.00       | 0.00                                   | 0.00       | 0.32       | 4.17         | 0.00       | --   |
| Benzaldehyde                                | --         | --                                     | --         | --         | --           | --         | --   |
| Aldehydes and Ketones<br>Total as % of THC, | 5.9<br>4.2 | 0.1<br>0.3                             | 0.1<br>0.3 | 0.9<br>4.5 | 37.6<br>47.0 | 1.7<br>0.9 | --   |
| Individual Hydrocarbons                     |            |                                        |            |            |              |            |      |
| Methane                                     | 20.54      | 7.11                                   | 4.51       | 4.51       | 57.00        | 25.42      | 6.13 |
| Ethylene                                    | 8.85       | 2.03                                   | 1.74       | 1.74       | 1.34         | 12.82      | 1.52 |
| Ethane                                      | 2.35       | 0.90                                   | 0.53       | 0.53       | 2.70         | 3.50       | 0.79 |
| Acetylene                                   | 2.05       | 0.05                                   | 0.11       | 0.11       | 0.00         | 3.69       | 0.05 |
| Propane                                     | 0.00       | 0.07                                   | 0.42       | 0.42       | 0.00         | 0.00       | 0.00 |
| Propylene                                   | 4.46       | 0.56                                   | 0.93       | 0.93       | 0.00         | 6.00       | 0.28 |
| Benzene                                     | 10.23      | 2.50                                   | 2.34       | 2.34       | 0.58         | 13.93      | 2.37 |
| Toluene                                     | 16.22      | 0.95                                   | 1.75       | 1.75       | 0.00         | 23.58      | 2.11 |
| Total Individual HC                         | 64.7       | 14.2                                   | 12.3       | 12.3       | 61.6         | 88.9       | 13.3 |
| Total as % of THC,                          | 46.2       | 71.0                                   | 61.5       | 61.5       | 77.0         | 49.4       | 44.3 |
| Organic Sulfides                            |            |                                        |            |            |              |            |      |
| Carbonyl Sulfide                            | 0.07       | 0.00                                   | 0.08       | 0.08       | 0.00         | 0.03       | --   |
| Methyl Sulfide                              | 0.00       | 0.03                                   | 0.02       | 0.02       | 0.00         | 0.00       | --   |
| Ethyl Sulfide                               | 0.00       | 0.00                                   | 0.00       | 0.00       | 0.00         | 0.02       | --   |
| Methyl Disulfide                            | 0.00       | 0.00                                   | 0.00       | 0.00       | 0.00         | 0.00       | --   |
| Organic Amines                              |            |                                        |            |            |              |            |      |
| Monomethylamine                             | 0.00       | 0.00                                   | 0.02       | 0.02       | 0.00         | 0.01       | --   |
| Dimethylamine                               | 0.01       | 0.00                                   | 0.03       | 0.03       | 0.04         | 0.02       | --   |
| Trimethylamine                              | 0.00       | 0.00                                   | 0.00       | 0.00       | 0.00         | 0.00       | --   |
| Diethylamine                                | 0.00       | 0.00                                   | 0.00       | 0.00       | 0.00         | 0.00       | --   |
| Triethylamine                               | 0.00       | 0.00                                   | 0.00       | 0.00       | 0.00         | 0.00       | --   |

Table B-33. Car 23, Fuel No. 3, 10,000 Miles

|                          | EMISSION RATE, MG/KM (Except as Noted) |        |        |        |        |        |        |        |
|--------------------------|----------------------------------------|--------|--------|--------|--------|--------|--------|--------|
|                          | FTP                                    | SET    | HFET   | NVCC   | FTP    | SET    | HFET   | NVCC   |
| Test Number, PMFEST      | 232311                                 | 232312 | 232313 | 232314 | 232321 | 232322 | 232323 | 232324 |
| Barometer, mm Hg         | 742.2                                  | 741.9  | 741.9  | 741.9  | 742.7  | 743.7  | 743.7  | 743.2  |
| Humidity, g/kg           | 10.2                                   | 10.9   | 9.9    | 10.4   | 6.6    | 13.6   | 12.6   | 8.3    |
| Temperature, °C          | 24.4                                   | 26.1   | 26.7   | 27.2   | 22.2   | 25.0   | 25.6   | 25.6   |
| Total Fuel Sulfur, mg/km | 24.75                                  | 20.98  | 19.18  | 37.62  | 24.55  | 21.09  | 18.83  | 38.48  |
| Carbon Dioxide, g/km     | 252.6                                  | 215.8  | 197.8  | 383.7  | 250.6  | 217.3  | 194.2  | 393.1  |
| Fuel Cons., l/100 km     | 10.92                                  | 9.26   | 8.46   | 16.60  | 10.83  | 9.31   | 8.31   | 16.98  |
| Regulated Emissions      |                                        |        |        |        |        |        |        |        |
| Hydrocarbons (THC), g/km | 0.12                                   | 0.03   | 0.02   | 0.07   | 0.13   | 0.03   | 0.02   | 0.11   |
| Carbon Monoxide, g/km    | 1.85                                   | 0.69   | 0.29   | 3.19   | 1.80   | 0.45   | 0.24   | 2.80   |
| Oxides of Nitrogen, g/km | 0.55                                   | 0.73   | 0.74   | 0.60   | 0.51   | 0.79   | 0.77   | 0.65   |
| Particulates             |                                        |        |        |        |        |        |        |        |
| Sulfate                  | 0.10                                   | 0.14   | 0.01   | 0.02   | 0.09   | 0.09   | 0.07   | 0.00   |
| Sulfate as % of TFS, %   | 0.13                                   | 0.22   | 0.02   | 0.02   | 0.12   | 0.14   | 0.12   | 0.00   |
| Compound Group Totals    |                                        |        |        |        |        |        |        |        |
| Aldehydes & Ketones      | 1.0                                    | 13.9   | 9.8    | 7.3    | 2.6    | 2.3    | 6.5    | 48.3   |
| Individual Hydrocarbons  | 48.2                                   | 14.3   | 11.3   | 71.1   | 51.8   | 13.4   | 18.1   | 82.1   |
| Organic Sulfides         | 0.01                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.05   | 0.02   | 0.18   |
| Organic Amines           | 0.04                                   | 0.04   | 0.03   | 0.04   | 0.05   | 0.03   | 0.01   | 0.18   |
| Other Compounds          |                                        |        |        |        |        |        |        |        |
| Ammonia                  | 9.99                                   | 10.07  | 5.10   | 37.18  | 9.55   | 3.06   | 1.68   | 27.06  |
| Cyanide & Cyanogen       | 1.89                                   | 1.75   | 0.88   | 3.95   | 1.36   | 0.45   | 1.00   | 3.35   |
| DMNA                     | --                                     | --     | --     | --     | --     | --     | --     | --     |
| Hydrogen Sulfide         | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Nickel Carbonyl          | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Nitrous Oxide            | 14.61                                  | 10.05  | 9.15   | 30.00  | 17.60  | 7.88   | 8.66   | 34.11  |
| Sulfur Dioxide           | 23.14                                  | 23.11  | 17.95  | 25.31  | 13.80  | 9.78   | 21.76  | 37.03  |

Table B-33 (Cont'd). Car 23, Fuel No. 3, 10,000 Miles

| Test Number,<br>Aldehydes and Ketones       | EMISSION RATE, MG/KM (Except as Noted) |              |             |             |            |            |             |              |
|---------------------------------------------|----------------------------------------|--------------|-------------|-------------|------------|------------|-------------|--------------|
|                                             | FTP                                    | SET          | HFET        | NVCC        | FTP        | SET        | HFET        | NVCC         |
| Formaldehyde                                | 0.00                                   | 0.23         | 0.00        | 0.00        | 0.00       | 0.00       | 0.00        | 0.00         |
| Acetaldehyde                                | 0.26                                   | 0.64         | 0.54        | 0.58        | 0.30       | 0.11       | 0.33        | 0.00         |
| Acetone                                     | 0.00                                   | 0.00         | 0.00        | 0.00        | 0.00       | 0.00       | 0.00        | 0.00         |
| Isobutyraldehyde                            | 0.74                                   | 12.03        | 8.10        | 6.73        | 2.30       | 1.95       | 5.68        | 48.26        |
| Methyl Ethyl Ketone                         | 0.00                                   | 0.00         | 0.00        | 0.00        | 0.00       | 0.00       | 0.00        | 0.00         |
| Crotonaldehyde                              | --                                     | --           | --          | --          | --         | --         | --          | --           |
| Hexanaldehyde                               | 0.00                                   | 0.99         | 1.14        | 0.00        | 0.00       | 0.25       | 0.44        | 0.00         |
| Benzaldehyde                                | --                                     | --           | --          | --          | --         | --         | --          | --           |
| Aldehydes and Ketones<br>Total as % of THC, | 1.0<br>0.8                             | 13.9<br>46.3 | 9.8<br>49.0 | 7.3<br>10.4 | 2.6<br>2.0 | 2.3<br>7.7 | 6.5<br>32.5 | 48.3<br>43.9 |
| Individual Hydrocarbons                     |                                        |              |             |             |            |            |             |              |
| Methane                                     | 21.89                                  | 8.57         | 5.79        | 56.88       | 22.30      | 7.63       | 4.98        | 62.83        |
| Ethylene                                    | 8.00                                   | 2.12         | 1.84        | 1.61        | 9.64       | 1.99       | 1.77        | 4.67         |
| Ethane                                      | 2.48                                   | 1.02         | 0.84        | 4.88        | 3.00       | 0.92       | 0.89        | 5.00         |
| Acetylene                                   | 2.13                                   | 0.05         | 0.04        | 0.00        | 2.43       | 0.05       | 0.19        | 0.00         |
| Propane                                     | 0.00                                   | 0.00         | 0.91        | 6.18        | 1.01       | 0.31       | 7.72        | 5.18         |
| Propylene                                   | 4.75                                   | 1.62         | 1.06        | 0.00        | 5.28       | 1.48       | 1.15        | 0.55         |
| Benzene                                     | 3.39                                   | 0.89         | 0.77        | 1.51        | 4.19       | 0.79       | 0.65        | 2.55         |
| Toluene                                     | 5.53                                   | 0.00         | 0.00        | 0.00        | 3.95       | 0.27       | 0.77        | 1.29         |
| Total Individual HC                         | 48.2                                   | 14.3         | 11.3        | 71.1        | 51.8       | 13.4       | 18.1        | 82.1         |
| Total as % of THC,                          | 40.2                                   | 47.7         | 56.5        | --          | 39.8       | 44.7       | 90.5        | 74.6         |
| Organic Sulfides                            |                                        |              |             |             |            |            |             |              |
| Carbonyl Sulfide                            | 0.00                                   | 0.00         | 0.00        | 0.00        | 0.00       | 0.00       | 0.00        | 0.00         |
| Methyl Sulfide                              | 0.01                                   | 0.00         | 0.00        | 0.00        | 0.00       | 0.04       | 0.00        | 0.00         |
| Ethyl Sulfide                               | 0.00                                   | 0.00         | 0.00        | 0.00        | 0.00       | 0.01       | 0.01        | 0.00         |
| Methyl Disulfide                            | 0.00                                   | 0.00         | 0.00        | 0.00        | 0.00       | 0.01       | 0.01        | 0.00         |
| Organic Amines                              |                                        |              |             |             |            |            |             |              |
| Monomethylamine                             | 0.03                                   | 0.02         | 0.00        | 0.00        | 0.03       | 0.02       | 0.00        | 0.00         |
| Dimethylamine                               | 0.01                                   | 0.02         | 0.03        | 0.04        | 0.02       | 0.01       | 0.01        | 0.18         |
| Trimethylamine                              | 0.00                                   | 0.00         | 0.00        | 0.00        | 0.00       | 0.00       | 0.00        | 0.00         |
| Diethylamine                                | 0.00                                   | 0.00         | 0.00        | 0.00        | 0.00       | 0.00       | 0.00        | 0.00         |
| Triethylamine                               | 0.00                                   | 0.00         | 0.00        | 0.00        | 0.00       | 0.00       | 0.00        | 0.00         |

Table B-34. CAR 23, FUEL NO. 1, 15,000 MILES

| EMISSION RATE, MG/KM (Except as Noted)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                               |                                 |                                 |                                 |                                 |                                 |                                 |                                 |                                 |                                 |                                 |                                 |                                 |                                 |                                 |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
| Test Number,<br>Barometer,<br>Humidity,<br>Temperature,<br><br>Total Fuel Sulfur, mg/km<br>Carbon Dioxide, g/km<br>Fuel Cons., g/100 km<br><br>Regulated Emissions<br>Hydrocarbons (THC), g/km<br>Carbon Monoxide, g/km<br>Oxides of Nitrogen, g/km<br><br>Particulates<br>Sulfate<br>Sulfate as % of TFS, %<br><br>Compound Group Totals<br>Aldehydes & Ketones<br>Individual Hydrocarbons<br>Organic Sulfides<br>Organic Amines<br><br>Other Compounds<br>Ammonia<br>Cyanide & Cyanogen<br>DMRA<br><br>Hydrogen Sulfide<br>Nickel Carbonyl<br>Nitrous Oxide<br>Sulfur Dioxide | POMFST<br>mm Hg<br>g/kg<br>°C | FTP                             |                                 | SET                             |                                 | HFET                            | NYCC                            |                                 | FTP                             |                                 | SET                             |                                 | HFET                            | NYCC                            |                                 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                               | 233111<br>742.7<br>10.2<br>22.8 | 233112<br>739.1<br>12.2<br>26.7 | 233113<br>739.1<br>12.2<br>26.7 | 233114<br>739.1<br>10.2<br>22.8 | 233121<br>740.4<br>15.0<br>25.6 | 233122<br>737.9<br>13.8<br>26.7 | 233121<br>740.4<br>15.0<br>25.6 | 233122<br>737.9<br>13.8<br>26.7 | 233123<br>728.0<br>13.5<br>26.1 | 233124<br>736.6<br>12.2<br>26.7 | 233121<br>740.4<br>15.0<br>25.6 | 233122<br>737.9<br>13.8<br>26.7 | 233123<br>728.0<br>13.5<br>26.1 | 233124<br>736.6<br>12.2<br>26.7 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                               | 0.86<br>265.8<br>11.48          | 0.72<br>222.4<br>9.54           | 0.64<br>199.5<br>8.54           | 1.28<br>394.5<br>17.02          | 0.86<br>262.2<br>11.38          | 0.65<br>200.9<br>8.62           | 0.65<br>202.0<br>8.64           | 1.27<br>389.6<br>16.85          |                                 |                                 |                                 |                                 |                                 |                                 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                               | 0.12<br>1.84<br>0.65            | 0.03<br>0.69<br>0.92            | 0.02<br>0.36<br>0.96            | 0.09<br>2.57<br>0.61            | 0.16<br>2.47<br>0.76            | 0.02<br>0.70<br>0.71            | 0.02<br>0.25<br>1.16            | 0.10<br>3.13<br>0.62            |                                 |                                 |                                 |                                 |                                 |                                 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                               | 0.09<br>3.49                    | 0.00<br>0.00                    | 0.05<br>2.60                    | 0.40<br>10.42                   | 0.06<br>2.33                    | 0.28<br>14.36                   | 0.05<br>2.56                    | 0.13<br>3.41                    |                                 |                                 |                                 |                                 |                                 |                                 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                               | 3.3<br>67.7<br>0.03<br>0.02     | 0.5<br>18.0<br>0.03<br>0.03     | 4.7<br>12.7<br>0.00<br>0.00     | 79.3<br>31.8<br>0.00<br>0.08    | 13.7<br>77.2<br>0.00<br>0.01    | 6.2<br>16.7<br>0.02<br>0.00     | 9.8<br>10.3<br>0.00<br>0.00     | 180.9<br>71.2<br>0.00<br>0.00   |                                 |                                 |                                 |                                 |                                 |                                 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                               | 1.30<br>2.53<br>--              | 0.75<br>1.95<br>--              | 1.26<br>1.09<br>--              | 10.30<br>6.03<br>--             | 0.86<br>2.88<br>--              | 0.30<br>1.18<br>--              | 0.67<br>1.37<br>--              | 4.49<br>5.29<br>--              |                                 |                                 |                                 |                                 |                                 |                                 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                               | 0.00<br>0.00<br>--              | 0.00<br>0.00<br>17.47           | 0.00<br>--<br>12.33             | 0.00<br>0.00<br>25.82           | 0.00<br>--<br>17.44             | 0.00<br>--<br>15.99             | 0.00<br>--<br>13.05             | 0.00<br>--<br>26.92             |                                 |                                 |                                 |                                 |                                 |                                 |

Table B-34 (Cont'd). CAR 23, FUEL NO. 1, 15,000 MILES  
EMISSION RATE, MG/HP (Except as Noted)

| Test Number, PUMPST     | FTP    |        | SET    |        | HFTP   |        | NYCC   |        | FTP    |        | SET    |        | HFTP   |        | NYCC   |        |
|-------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|                         | 233111 | 233112 | 233113 | 233114 | 233121 | 233122 | 233123 | 233124 | 233121 | 233122 | 233123 | 233124 | 233121 | 233122 | 233123 | 233124 |
| Aldehydes and Ketones   |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |
| Formaldehyde            | 0.00   | 0.00   | 0.56   | 0.00   | 0.28   | 0.00   | 0.00   | 0.00   | 0.28   | 0.00   | 0.00   | 0.00   | 0.28   | 0.00   | 0.00   | 0.00   |
| Acetaldehyde            | 0.01   | 0.26   | 0.00   | 1.57   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Acetone                 | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Isobutyraldehyde        | 2.11   | 0.00   | 4.16   | 73.73  | 12.71  | 6.02   | 9.22   | --     | 12.71  | 6.02   | 9.22   | --     | 12.71  | 6.02   | 9.22   | --     |
| Methyl Ethyl Ketone     | 0.06   | 0.06   | 0.00   | 0.00   | 0.33   | 0.05   | 0.25   | 0.00   | 0.33   | 0.05   | 0.25   | 0.00   | 0.33   | 0.05   | 0.25   | 0.00   |
| Crotonaldehyde          | --     | --     | --     | --     | --     | --     | --     | --     | --     | --     | --     | --     | --     | --     | --     | --     |
| Hexanaldehyde           | 0.35   | 0.18   | 0.00   | 4.01   | 0.41   | 0.17   | 0.33   | 2.48   | 0.41   | 0.17   | 0.33   | 2.48   | 0.41   | 0.17   | 0.33   | 2.48   |
| Benzaldehyde            | --     | --     | --     | --     | --     | --     | --     | --     | --     | --     | --     | --     | --     | --     | --     | --     |
| Aldehydes and Ketones   | 1.3    | 0.5    | 4.7    | 79.3   | 13.7   | 6.2    | 9.8    | 2.48   | 13.7   | 6.2    | 9.8    | 2.48   | 13.7   | 6.2    | 9.8    | 2.48   |
| Total as % of THC, %    | 2.8    | 1.7    | 23.5   | 88.1   | 8.6    | 31.0   | 49.0   | 2.5    | 8.6    | 31.0   | 49.0   | 2.5    | 8.6    | 31.0   | 49.0   | 2.5    |
| Individual Hydrocarbons |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |
| Methane                 | 20.44  | 8.79   | 5.38   | 17.37  | 23.90  | 8.56   | 5.40   | 56.95  | 23.90  | 8.56   | 5.40   | 56.95  | 23.90  | 8.56   | 5.40   | 56.95  |
| Ethylene                | 7.65   | 1.68   | 1.68   | 1.09   | 10.01  | 1.61   | 0.96   | 2.17   | 10.01  | 1.61   | 0.96   | 2.17   | 10.01  | 1.61   | 0.96   | 2.17   |
| Ethane                  | 2.14   | 1.15   | 0.47   | 4.38   | 2.39   | 0.77   | 0.34   | 4.93   | 2.39   | 0.77   | 0.34   | 4.93   | 2.39   | 0.77   | 0.34   | 4.93   |
| Acetylene               | 2.18   | 0.10   | 0.11   | 0.00   | 3.02   | 0.10   | 0.07   | 1.00   | 3.02   | 0.10   | 0.07   | 1.00   | 3.02   | 0.10   | 0.07   | 1.00   |
| Propane                 | 1.58   | 0.10   | 0.12   | 2.08   | 0.00   | 0.00   | 0.55   | 0.00   | 0.00   | 0.00   | 0.55   | 0.00   | 0.00   | 0.00   | 0.55   | 0.00   |
| Propylene               | 4.06   | 0.56   | 1.00   | 0.00   | 4.65   | 0.55   | 0.20   | 0.00   | 4.65   | 0.55   | 0.20   | 0.00   | 4.65   | 0.55   | 0.20   | 0.00   |
| Benzene                 | 20.61  | 5.12   | 2.53   | 6.86   | 22.44  | 4.03   | 2.77   | 5.68   | 22.44  | 4.03   | 2.77   | 5.68   | 22.44  | 4.03   | 2.77   | 5.68   |
| Toluene                 | 9.04   | 0.53   | 1.36   | 0.00   | 10.83  | 1.04   | 0.00   | 0.51   | 10.83  | 1.04   | 0.00   | 0.51   | 10.83  | 1.04   | 0.00   | 0.51   |
| Total Individual HC     | 67.7   | 18.0   | 12.7   | 31.8   | 77.2   | 16.7   | 10.3   | 71.2   | 77.2   | 16.7   | 10.3   | 71.2   | 77.2   | 16.7   | 10.3   | 71.2   |
| Total as % of THC, %    | 56.4   | 40.0   | 63.5   | 35.3   | 48.3   | 83.5   | 51.5   | 71.2   | 48.3   | 83.5   | 51.5   | 71.2   | 48.3   | 83.5   | 51.5   | 71.2   |
| Organic Sulfides        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |
| Carbonyl Sulfide        | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Methyl Sulfide          | 0.03   | 0.03   | 0.00   | 0.00   | 0.00   | 0.02   | 0.00   | 0.00   | 0.00   | 0.02   | 0.00   | 0.00   | 0.00   | 0.02   | 0.00   | 0.00   |
| Ethyl Sulfide           | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Methyl Disulfide        | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Organic Amines          |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |
| Monomethylamine         | 0.00   | 0.00   | 0.00   | 0.00   | 0.01   | 0.00   | 0.00   | 0.00   | 0.01   | 0.00   | 0.00   | 0.00   | 0.01   | 0.00   | 0.00   | 0.00   |
| Dimethylamine           | 0.02   | 0.03   | 0.00   | 0.08   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Trimethylamine          | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Diethylamine            | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Triethylamine           | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |

Table B-35. CAR 23, FUEL NO. 2, 15,000 MILES

|                          | EMISSION RATE, MG/KM (Except as Noted) |        |        |        |        |        |        |        |
|--------------------------|----------------------------------------|--------|--------|--------|--------|--------|--------|--------|
|                          | FTP                                    | SET    | HFET   | NYCC   | FTP    | SET    | HFET   | NYCC   |
| Test Number, PMWST       | 233211                                 | 233212 | 233213 | 233214 | 233221 | 233222 | 233223 | 233224 |
| Barometer, mm Hg         | 742.7                                  | 743.2  | 743.2  | 743.2  | 745.0  | 747.8  | 747.8  | 747.8  |
| Humidity, g/kg           | 5.6                                    | 5.7    | 6.4    | 5.7    | 3.4    | 4.6    | 4.7    | 3.7    |
| Temperature, °C          | 24.4                                   | 25.6   | 25.6   | 25.6   | 21.7   | 23.9   | 25.0   | 23.3   |
| Total Fuel Sulfur, mg/km | 24.77                                  | 21.20  | 18.96  | 38.44  | 25.49  | 21.02  | 19.93  | 39.68  |
| Carbon Dioxide, g/km     | 252.4                                  | 219.0  | 196.1  | 393.8  | 260.3  | 217.2  | 206.2  | 405.5  |
| Fuel Cons., L/100 km     | 10.96                                  | 9.39   | 8.39   | 17.02  | 11.28  | 9.30   | 8.82   | 17.56  |
| Regulated Emissions      |                                        |        |        |        |        |        |        |        |
| Hydrocarbons (THC), g/km | 0.14                                   | 0.03   | 0.03   | 0.14   | 0.14   | 0.03   | 0.02   | 0.09   |
| Carbon Monoxide, g/km    | 2.54                                   | 0.55   | 0.27   | 2.84   | 2.28   | 0.45   | 0.27   | 3.67   |
| Oxides of Nitrogen, g/km | 0.66                                   | 0.87   | 0.94   | 0.55   | 0.64   | 0.90   | 1.09   | 0.59   |
| Particulates             |                                        |        |        |        |        |        |        |        |
| Sulfate                  | 0.08                                   | 0.02   | 0.00   | 0.17   | 0.00   | 0.01   | 0.00   | 0.13   |
| Sulfate as % of TSS, %   | 0.11                                   | 0.03   | 0.00   | 0.15   | 0.00   | 0.02   | 0.00   | 0.11   |
| Compound Group Totals    |                                        |        |        |        |        |        |        |        |
| Aldehydes & Ketones      | 8.5                                    | 6.1    | 9.8    | 93.9   | 0.3    | 2.0    | 9.9    | 53.0   |
| Individual Hydrocarbons  | 62.8                                   | 14.4   | 11.2   | 55.2   | 58.4   | 14.8   | 11.7   | 65.4   |
| Organic Sulfides         | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Organic Amines           | 0.08                                   | 0.05   | 0.03   | 0.00   | 0.03   | 0.07   | 0.02   | 0.00   |
| Other Compounds          |                                        |        |        |        |        |        |        |        |
| Ammonia                  | 1.87                                   | 4.24   | 2.35   | 11.33  | 1.95   | 1.04   | 0.98   | 5.19   |
| Cyanide & Cyanogen       | 2.44                                   | 0.17   | 1.16   | 4.55   | 2.13   | 0.08   | 0.77   | 8.32   |
| THM                      | --                                     | --     | --     | --     | --     | --     | --     | --     |
| Hydrogen Sulfide         | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Methyl Carbonyl          | 0.00                                   | 0.00   | 0.00   | 0.00   | --     | --     | --     | --     |
| Nitrous Oxide            | 26.43                                  | 16.28  | 16.43  | 57.12  | 25.01  | 19.81  | 18.17  | 64.74  |
| Sulfur Dioxide           | 37.16                                  | 26.13  | 32.13  | 20.63  | 38.36  | 32.92  | 129.24 | 47.66  |



Table 8-35 (Cont'd). CAR 23, FUEL NO. 2, 15,000 RILES

| EMISSION RATE, MG/HR (Except as Noted) |       | NYCT |      | NYCT  |       | NYCT |      | NYCT  |      |
|----------------------------------------|-------|------|------|-------|-------|------|------|-------|------|
| FTP                                    | SET   | FTP  | SET  | FTP   | SET   | FTP  | SET  | FTP   | NYCT |
| <b>Test Number, FINEST</b>             |       |      |      |       |       |      |      |       |      |
| <b>Aldehydes and Ketones</b>           |       |      |      |       |       |      |      |       |      |
| Formaldehyde                           | 0.27  | 0.00 | 0.15 | 1.15  | 0.01  | 0.00 | 0.45 | 0.16  |      |
| Acetaldehyde                           | 0.88  | 0.44 | 0.72 | 7.73  | 0.07  | 0.00 | 1.12 | 6.84  |      |
| Acetone                                | 0.00  | 0.00 | 0.00 | 0.00  | 0.00  | 0.00 | 0.00 | 0.00  |      |
| Isobutyraldehyde                       | 6.00  | 4.62 | 7.34 | 73.08 | 0.00  | 2.01 | 7.26 | 37.08 |      |
| Methyl Ethyl Ketone                    | 0.70  | 0.41 | 1.00 | 6.04  | 0.00  | 0.00 | 0.50 | 2.55  |      |
| Crotonaldehyde                         | --    | --   | --   | --    | --    | --   | --   | --    |      |
| Hexanaldehyde                          | 0.68  | 0.65 | 0.60 | 5.93  | 0.17  | 0.00 | 0.52 | 6.41  |      |
| Benzaldehyde                           | --    | --   | --   | --    | --    | --   | --   | --    |      |
| Aldehydes and Ketones                  | 8.5   | 6.1  | 9.8  | 93.9  | 0.3   | 2.0  | 9.9  | 53.0  |      |
| Total as % of THC,                     | 6.1   | 20.3 | 32.7 | 67.1  | 0.2   | 6.7  | 49.5 | 58.9  |      |
| <b>Individual Hydrocarbons</b>         |       |      |      |       |       |      |      |       |      |
| Methane                                | 22.16 | 7.88 | 5.59 | 48.60 | 19.73 | 7.89 | 5.60 | 54.91 |      |
| Ethylene                               | 8.92  | 1.95 | 1.60 | 0.56  | 6.92  | 1.51 | 1.54 | 0.55  |      |
| Ethane                                 | 2.22  | 0.79 | 0.63 | 4.19  | 2.14  | 0.97 | 0.88 | 4.76  |      |
| Acetylene                              | 2.19  | 0.00 | 0.04 | 0.00  | 2.50  | 0.00 | 0.08 | 0.00  |      |
| Propane                                | 0.00  | 0.00 | 0.00 | 0.00  | 0.00  | 0.00 | 0.50 | 0.53  |      |
| Propylene                              | 4.12  | 0.84 | 0.33 | 0.00  | 3.36  | 0.56 | 0.42 | 0.00  |      |
| Benzene                                | 10.25 | 1.63 | 1.89 | 0.82  | 9.97  | 2.28 | 1.89 | 4.62  |      |
| Toluene                                | 12.96 | 1.31 | 1.15 | 1.04  | 13.78 | 1.57 | 0.98 | 0.00  |      |
| Total Individual HC                    | 62.8  | 14.4 | 11.2 | 55.2  | 58.4  | 14.8 | 11.7 | 65.4  |      |
| Total as % of THC,                     | 44.9  | 48.0 | 37.3 | 39.4  | 41.7  | 49.3 | 58.5 | 72.7  |      |
| <b>Organic Sulfides</b>                |       |      |      |       |       |      |      |       |      |
| Carbonyl Sulfide                       | 0.00  | 0.00 | 0.00 | 0.00  | 0.00  | 0.00 | 0.00 | 0.00  |      |
| Methyl Sulfide                         | 0.00  | 0.00 | 0.00 | 0.00  | 0.00  | 0.00 | 0.00 | 0.00  |      |
| Ethyl Sulfide                          | 0.00  | 0.00 | 0.00 | 0.00  | 0.00  | 0.00 | 0.00 | 0.00  |      |
| Methyl Mercaptan                       | 0.00  | 0.00 | 0.00 | 0.00  | 0.00  | 0.00 | 0.00 | 0.00  |      |
| <b>Organic Amines</b>                  |       |      |      |       |       |      |      |       |      |
| Monoethylamine                         | 0.02  | 0.00 | 0.00 | 0.00  | 0.01  | 0.00 | 0.02 | 0.00  |      |
| Monoethylamine                         | 0.01  | 0.05 | 0.03 | 0.00  | 0.02  | 0.07 | 0.00 | 0.00  |      |
| Trimethylamine                         | 0.05  | 0.00 | 0.00 | 0.00  | 0.00  | 0.00 | 0.00 | 0.00  |      |
| Diethylamine                           | 0.00  | 0.00 | 0.00 | 0.00  | 0.00  | 0.00 | 0.00 | 0.00  |      |
| Triethylamine                          | 0.00  | 0.00 | 0.00 | 0.00  | 0.00  | 0.00 | 0.00 | 0.00  |      |

Table B-36. CAR 23, FUEL NO. 3, 15,000 MILES

|                          | EMISSION RATE, MG/HR (Except as Noted) |        |        |        |        |        |        |        |     |      |
|--------------------------|----------------------------------------|--------|--------|--------|--------|--------|--------|--------|-----|------|
|                          | FTP                                    | SET    | MFET   | MYCC   | PTF    | SET    | MFET   | MYCC   | PTF | MYCC |
| Test Number, P00057      | 233311                                 | 233312 | 233313 | 233314 | 233321 | 233322 | 233323 | 233324 |     |      |
| Barometer, mm Hg         | 743.5                                  | 741.9  | 741.9  | 741.4  | 739.6  | 739.6  | 739.6  | 739.6  |     |      |
| Humidity, g/kg           | 9.2                                    | 9.5    | 9.5    | 10.0   | 13.2   | 13.2   | 13.2   | 13.2   |     |      |
| Temperature, °C          | 23.3                                   | 24.4   | 24.4   | 23.3   | 26.1   | 26.1   | 26.1   | 26.1   |     |      |
| Total Fuel Sulfur, mg/km | 25.27                                  | 21.14  | 19.24  | 37.99  | 25.99  | 21.56  | 19.60  | 36.26  |     |      |
| Carbon Dioxide, g/km     | 257.2                                  | 217.4  | 198.4  | 368.3  | 264.0  | 221.9  | 202.1  | 391.7  |     |      |
| Fuel Cons., g/100 km     | 11.15                                  | 9.33   | 8.49   | 16.77  | 11.47  | 9.52   | 8.65   | 16.93  |     |      |
| Regulated Emissions      |                                        |        |        |        |        |        |        |        |     |      |
| Hydrocarbons (THC), g/km | 0.14                                   | 0.03   | 0.02   | 0.05   | 0.17   | 0.03   | 0.02   | 0.04   |     |      |
| Carbon Monoxide, g/km    | 2.27                                   | 0.70   | 0.34   | 2.80   | 2.61   | 0.59   | 0.31   | 3.06   |     |      |
| Oxides of Nitrogen, g/km | 0.64                                   | 0.92   | 1.02   | 0.66   | 0.65   | 0.94   | 1.05   | 0.71   |     |      |
| Particulates             |                                        |        |        |        |        |        |        |        |     |      |
| Sulfate                  | 0.16                                   | 0.05   | 0.01   | 0.04   | 0.06   | 0.01   | 0.01   | 0.27   |     |      |
| Sulfate as % of TFS, %   | 0.21                                   | 0.08   | 0.02   | 0.04   | 0.08   | 0.02   | 0.02   | 0.24   |     |      |
| Compound Group Totals    |                                        |        |        |        |        |        |        |        |     |      |
| Aldehydes & Ketones      | 8.8                                    | 0.6    | 6.6    | 18.3   | 6.5    | 6.3    | 7.2    | 88.8   |     |      |
| Individual Hydrocarbons  | 60.4                                   | 15.5   | 13.2   | 92.6   | 69.4   | 16.3   | 15.6   | 98.6   |     |      |
| Organic Sulfides         | 0.02                                   | 0.00   | --     | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |     |      |
| Organic Amines           | 0.02                                   | 0.03   | --     | 0.00   | 0.03   | 0.02   | 0.06   | --     |     |      |
| Other Compounds          |                                        |        |        |        |        |        |        |        |     |      |
| Ammonia                  | 3.54                                   | 1.17   | 1.41   | 17.98  | 1.29   | 0.32   | 2.02   | --     |     |      |
| Cyanide & Cyanogen       | 2.45                                   | 0.69   | 1.14   | 4.91   | 2.01   | 0.96   | 1.15   | 4.90   |     |      |
| DMBA                     | --                                     | --     | --     | --     | --     | --     | --     | --     |     |      |
| Hydrogen Sulfide         | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |     |      |
| Nickel Carbonyl          | --                                     | --     | --     | --     | 0.00   | 0.00   | 0.00   | 0.00   |     |      |
| Nitrous Oxide            | 23.83                                  | 12.60  | 10.65  | 40.83  | 15.84  | 7.85   | 10.80  | 22.71  |     |      |
| Sulfur Dioxide           | 33.87                                  | 28.42  | 25.66  | 38.28  | 32.13  | 27.83  | 23.04  | --     |     |      |

Table B-36 (Cont'd). CAR 23, FUEL NO. 3, 15,000 MILES

| Test Number,                                | EMISSION RATE, MG/KM (Except as Noted) |            |             |              |            |             |             |            |
|---------------------------------------------|----------------------------------------|------------|-------------|--------------|------------|-------------|-------------|------------|
|                                             | FTP                                    | SET        | HFET        | NYCC         | FTP        | SET         | HFET        | NYCC       |
| <b>Aldehydes and Ketones</b>                |                                        |            |             |              |            |             |             |            |
| Formaldehyde                                | 0.91                                   | 0.03       | 0.41        | 0.00         | 0.16       | 0.00        | 0.00        | 0.00       |
| Acetaldehyde                                | 0.98                                   | 0.16       | 1.00        | 1.11         | 1.10       | 0.59        | 0.93        | 9.02       |
| Acetone                                     | 0.00                                   | 0.00       | 0.00        | 0.00         | 0.00       | 0.00        | 0.00        | 0.00       |
| Isobutyraldehyde                            | 5.31                                   | 0.00       | 4.33        | 11.61        | 3.84       | 4.70        | 4.99        | 67.02      |
| Methyl Ethyl Ketone                         | 0.71                                   | 0.14       | 0.37        | 2.09         | 0.70       | 0.42        | 0.60        | 6.00       |
| Crotonaldehyde                              | 0.92                                   | --         | --          | --           | --         | --          | --          | --         |
| Hexanaldehyde                               | --                                     | 0.31       | 0.46        | 3.52         | 0.71       | 0.54        | 0.66        | 6.76       |
| Benzaldehyde                                | --                                     | --         | --          | --           | --         | --          | --          | --         |
| Aldehydes and Ketones<br>Total as % of THC, | 8.8<br>6.3                             | 0.6<br>2.0 | 6.6<br>33.0 | 18.3<br>36.6 | 6.5<br>3.8 | 6.3<br>21.0 | 7.2<br>36.0 | 88.8<br>-- |
| <b>Individual Hydrocarbons</b>              |                                        |            |             |              |            |             |             |            |
| Methane                                     | 28.37                                  | 9.80       | 5.68        | 52.15        | 30.61      | 9.56        | 6.25        | 57.88      |
| Ethylene                                    | 10.40                                  | 2.11       | 1.69        | 2.62         | 12.52      | 2.16        | 1.92        | 4.36       |
| Ethane                                      | 3.22                                   | 1.12       | 0.95        | 5.99         | 3.70       | 1.03        | 0.99        | 5.30       |
| Acetylene                                   | 2.72                                   | 0.05       | 0.07        | 0.00         | 3.29       | 0.10        | 0.04        | 0.00       |
| Propane                                     | 0.00                                   | 0.06       | 2.02        | 26.96        | 0.00       | 0.04        | 3.41        | 23.90      |
| Propylene                                   | 5.22                                   | 1.67       | 1.05        | 0.00         | 6.82       | 1.38        | 1.19        | 0.00       |
| Benzene                                     | 4.99                                   | 0.57       | 0.86        | 4.87         | 6.56       | 1.52        | 1.20        | 4.86       |
| Toluene                                     | 5.47                                   | 0.16       | 0.38        | 0.00         | 5.86       | 0.52        | 0.58        | 2.30       |
| Total Individual HC                         | 60.4                                   | 15.5       | 13.2        | 92.6         | 69.4       | 16.3        | 15.6        | 98.6       |
| Total as % of THC,                          | 43.1                                   | 51.7       | 66.0        | --           | 40.8       | 54.3        | 78.0        | --         |
| <b>Organic Sulfides</b>                     |                                        |            |             |              |            |             |             |            |
| Carbonyl Sulfide                            | 0.00                                   | 0.00       | --          | 0.00         | 0.00       | 0.00        | 0.00        | 0.00       |
| Methyl Sulfide                              | 0.02                                   | 0.00       | --          | 0.00         | 0.00       | 0.00        | 0.00        | 0.00       |
| Ethyl Sulfide                               | 0.00                                   | 0.00       | --          | 0.00         | 0.00       | 0.00        | 0.00        | 0.00       |
| Methyl Disulfide                            | 0.00                                   | 0.00       | --          | 0.00         | 0.00       | 0.00        | 0.00        | 0.00       |
| <b>Organic Amines</b>                       |                                        |            |             |              |            |             |             |            |
| Monomethylamine                             | 0.00                                   | 0.00       | --          | 0.00         | 0.01       | 0.00        | 0.02        | --         |
| Dimethylamine                               | 0.00                                   | 0.00       | --          | 0.00         | 0.01       | 0.02        | 0.01        | --         |
| Trimethylamine                              | 0.02                                   | 0.03       | --          | 0.00         | 0.01       | 0.00        | 0.03        | --         |
| Diethylamine                                | 0.00                                   | 0.00       | --          | 0.00         | 0.00       | 0.00        | 0.00        | --         |
| Triethylamine                               | 0.00                                   | 0.00       | --          | 0.00         | 0.00       | 0.00        | 0.00        | --         |

Table B-37. Car 26, Fuel #1, Initial Mileage

|                          | EMISSION RATE, MG/KM (Except as Noted) |        |        |        |        |        |        |        |
|--------------------------|----------------------------------------|--------|--------|--------|--------|--------|--------|--------|
|                          | FTP                                    | SET    | HFET   | NYCC   | FTP    | SET    | HFET   | NYCC   |
| Test Number, FVWST       | 240111                                 | 240112 | 240113 | 240114 | 240121 | 240122 | 240123 | 240124 |
| Barometer, mm Hg         | 737.1                                  | 741.2  | 741.2  | 741.2  | 745.0  | 745.2  | 745.2  | 745.2  |
| Humidity, g/kg           | 9.1                                    | 9.1    | 8.1    | 11.6   | 7.3    | 7.7    | 7.7    | 7.4    |
| Temperature, °C          | 23.9                                   | 22.2   | 24.4   | 24.4   | 23.3   | 23.9   | 23.9   | 24.4   |
| Total Fuel Sulfur, mg/km | 1.29                                   | 0.94   | 0.87   | 2.40   | 1.27   | 0.95   | 0.87   | 2.30   |
| Carbon Dioxide, g/km     | 398.9                                  | 292.6  | 269.4  | 743.3  | 393.3  | 294.4  | 270.2  | 714.6  |
| Fuel Cons., l/100 km     | 17.10                                  | 12.51  | 11.50  | 31.83  | 16.86  | 12.58  | 11.54  | 30.58  |
| Regulated Emissions      |                                        |        |        |        |        |        |        |        |
| Hydrocarbons (THC), g/km | 0.15                                   | 0.03   | 0.01   | 0.27   | 0.12   | 0.03   | 0.01   | 0.23   |
| Carbon Monoxide, g/km    | 0.82                                   | 0.24   | 0.04   | 0.95   | 0.79   | 0.16   | 0.03   | 0.81   |
| Oxides of Nitrogen, g/km | 0.85                                   | 1.33   | 1.39   | 0.79   | 0.76   | 1.35   | 1.59   | 0.70   |
| Particulates             |                                        |        |        |        |        |        |        |        |
| Sulfate                  | 0.16                                   | 0.07   | 0.48   | 0.81   | 0.08   | 0.07   | 0.50   | 0.29   |
| Sulfate as % of TFS, %   | 4.13                                   | 2.48   | 18.39  | 11.25  | 2.10   | 2.46   | 19.16  | 4.20   |
| Compound Group Totals    |                                        |        |        |        |        |        |        |        |
| Aldehydes & Ketones      | 2.7                                    | 4.6    | 5.1    | 6.0    | 4.6    | 4.6    | 4.3    | 8.4    |
| Individual Hydrocarbons  | 74.8                                   | 19.7   | 6.3    | 214.4  | 79.3   | 19.4   | 5.0    | 164.8  |
| Organic Sulfides         | 0.10                                   | 0.06   | 0.01   | 0.00   | 0.29   | 0.17   | 0.04   | 0.73   |
| Organic Amines           | 0.00                                   | 0.02   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Other Compounds          |                                        |        |        |        |        |        |        |        |
| Ammonia                  | 3.98                                   | 0.51   | 0.57   | 6.63   | 0.19   | 0.00   | 1.15   | 2.00   |
| Cyanide & Cyanogen       | 0.32                                   | 0.00   | 0.00   | 0.78   | 0.24   | 0.19   | 0.21   | 3.07   |
| DBPA                     |                                        |        |        |        |        |        |        |        |
| Hydrogen Sulfide         | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Nickel Carbonyl          | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Bitrous Oxide            | 24.35                                  | 16.83  | 10.44  | 30.99  | 22.39  | 17.03  | 12.66  | 23.02  |
| Sulfur Dioxide           | --                                     | --     | --     | --     | --     | --     | --     | --     |

Table B-37 (Cont'd), Car 24, Fuel #1, Initial Mileage  
EMISSION RATE, MG/KH (Except as Noted)

| Test Number,<br>Fuel #1, Initial Mileage    | FPM/ST     | FTP         | SET         | HFET       | NVCC       | FTP         | SET         | HFET       | NVCC       |
|---------------------------------------------|------------|-------------|-------------|------------|------------|-------------|-------------|------------|------------|
|                                             |            |             |             |            |            |             |             |            |            |
| Aldehydes and Ketones                       |            |             |             |            |            |             |             |            |            |
| Formaldehyde                                | 2.73       | 4.04        | 4.92        | 1.20       | 3.28       | 4.35        | 4.30        | 2.22       | 2.22       |
| Acetaldehyde                                | 0.00       | 0.19        | 0.10        | 0.84       | 0.43       | 0.08        | 0.00        | 0.90       | 0.90       |
| Acetone                                     | 0.00       | 0.05        | 0.00        | 1.57       | 0.40       | 0.00        | 0.00        | 2.87       | 2.87       |
| Isobutyraldehyde                            | 0.00       | 0.00        | 0.19        | 2.42       | 0.22       | 0.21        | 0.00        | 2.38       | 2.38       |
| Methyl Ethyl Ketone                         | 0.00       | 0.27        | 0.00        | 0.00       | 0.28       | 0.00        | 0.00        | 0.00       | 0.00       |
| Crotonaldehyde                              | 0.00       | 0.00        | 0.00        | 0.00       | 0.00       | 0.00        | 0.00        | 0.00       | 0.00       |
| Hexanaldehyde                               | 0.00       | 0.00        | 0.00        | 0.00       | 0.00       | 0.00        | 0.00        | 0.00       | 0.00       |
| Benzaldehyde                                | 0.00       | 0.00        | 0.00        | 0.00       | 0.00       | 0.00        | 0.00        | 0.00       | 0.00       |
| Aldehydes and Ketones<br>Total as % of THC, | 2.7<br>1.8 | 4.6<br>15.3 | 5.1<br>51.0 | 6.0<br>2.2 | 4.6<br>3.8 | 4.6<br>15.3 | 4.3<br>43.0 | 8.4<br>3.7 | 8.4<br>3.7 |
| Individual Hydrocarbons                     |            |             |             |            |            |             |             |            |            |
| Methane                                     | 52.04      | 16.86       | 4.96        | 104.49     | 57.28      | 16.97       | 4.87        | 148.43     | 148.43     |
| Ethylene                                    | 2.80       | 0.00        | 0.00        | 0.00       | 3.23       | 0.28        | 0.00        | 1.37       | 1.37       |
| Ethane                                      | 4.57       | 0.92        | 0.24        | 14.88      | 5.43       | 1.25        | 0.13        | 11.98      | 11.98      |
| Acetylene                                   | 0.56       | 0.00        | 0.00        | 0.00       | 0.49       | 0.00        | 0.00        | 0.00       | 0.00       |
| Propane                                     | 0.04       | 1.00        | 0.61        | 8.77       | 0.26       | 0.33        | 0.00        | 0.00       | 0.00       |
| Propylene                                   | 1.22       | 0.00        | 0.00        | 0.00       | 1.22       | 0.00        | 0.00        | 0.00       | 0.00       |
| Benzene                                     | 5.65       | 0.40        | 0.22        | 3.65       | 5.46       | 0.53        | 0.00        | 3.06       | 3.06       |
| Toluene                                     | 7.91       | 0.53        | 0.30        | 2.57       | 5.89       | 0.00        | 0.00        | 0.00       | 0.00       |
| Total Individual HC                         | 74.8       | 19.7        | 6.3         | 214.4      | 79.3       | 19.4        | 5.0         | 164.8      | 164.8      |
| Total as % of THC,                          | 49.9       | 65.7        | 63.0        | 79.4       | 66.1       | 64.7        | 50.0        | 71.7       | 71.7       |
| Organic Sulfides                            |            |             |             |            |            |             |             |            |            |
| Carbonyl Sulfide                            | 0.00       | 0.02        | 0.00        | 0.00       | 0.13       | 0.09        | 0.02        | 0.33       | 0.33       |
| Methyl Sulfide                              | 0.00       | 0.04        | 0.01        | 0.00       | 0.07       | 0.08        | 0.02        | 0.40       | 0.40       |
| Ethyl Sulfide                               | 0.07       | 0.00        | 0.00        | 0.00       | 0.05       | 0.00        | 0.00        | 0.00       | 0.00       |
| Methyl Disulfide                            | 0.03       | 0.00        | 0.00        | 0.00       | 0.04       | 0.00        | 0.00        | 0.00       | 0.00       |
| Organic Amines                              |            |             |             |            |            |             |             |            |            |
| Monomethylamine                             | 0.00       | 0.02        | 0.00        | 0.00       | 0.00       | 0.00        | 0.00        | 0.00       | 0.00       |
| Dimethylamine                               | 0.00       | 0.00        | 0.00        | 0.00       | 0.00       | 0.00        | 0.00        | 0.00       | 0.00       |
| Trimethylamine                              | 0.00       | 0.00        | 0.00        | 0.00       | 0.00       | 0.00        | 0.00        | 0.00       | 0.00       |
| Diethylamine                                | 0.00       | 0.00        | 0.00        | 0.00       | 0.00       | 0.00        | 0.00        | 0.00       | 0.00       |
| Triethylamine                               | 0.00       | 0.00        | 0.00        | 0.00       | 0.00       | 0.00        | 0.00        | 0.00       | 0.00       |

Table B-38. Car 24, Fuel #2, Initial Mileage

|                          | EMISSION RATE, MG/KM (Except as Noted) |        |        |        |        |        |        |        |
|--------------------------|----------------------------------------|--------|--------|--------|--------|--------|--------|--------|
|                          | FTP                                    | SET    | HFT    | NYCC   | FTP    | SET    | HFT    | NYCC   |
| Test Number,             | 240211                                 | 240212 | 240213 | 240214 | 240221 | 240222 | 240223 | 240224 |
| Barometer, mm Hg         | 745.0                                  | 745.0  | 745.0  | 745.0  | 743.5  | 743.7  | 743.7  | 743.7  |
| Humidity, g/kg           | 9.9                                    | 9.9    | 12.0   | 9.9    | 11.6   | 8.8    | 9.9    | 7.7    |
| Temperature, °C          | 23.3                                   | 23.3   | 25.0   | 25.0   | 21.1   | 22.8   | 26.7   | 23.9   |
| Total Fuel Sulfur, mg/km | 39.70                                  | 28.65  | 26.30  | 70.17  | 39.38  | 28.53  | 26.38  | 71.29  |
| Carbon Dioxide, g/km     | 408.7                                  | 296.6  | 272.7  | 725.4  | 405.9  | 295.6  | 273.5  | 736.7  |
| Fuel Cons., l/100 km     | 17.57                                  | 12.68  | 11.64  | 31.06  | 17.43  | 12.63  | 11.68  | 31.56  |
| Regulated Emissions      |                                        |        |        |        |        |        |        |        |
| Hydrocarbons (THC), g/km | 0.16                                   | 0.03   | 0.01   | 0.25   | 0.17   | 0.02   | 0.01   | 0.28   |
| Carbon Monoxide, g/km    | 1.59                                   | 0.30   | 0.04   | 1.05   | 1.33   | 0.16   | 0.04   | 1.16   |
| Oxides of Nitrogen, g/km | 0.80                                   | 1.38   | 1.43   | 0.76   | 0.82   | 1.30   | 1.41   | 0.72   |
| Particulates             |                                        |        |        |        |        |        |        |        |
| Sulfate                  | 0.52                                   | 0.24   | 0.71   | 0.39   | 0.35   | 0.19   | 0.45   | 0.11   |
| Sulfate as % of TFS, %   | 0.44                                   | 0.28   | 0.90   | 0.19   | 0.30   | 0.22   | 0.57   | 0.05   |
| Compound Group Totals    |                                        |        |        |        |        |        |        |        |
| Aldehydes & Ketones      | 5.6                                    | 1.8    | 3.8    | 5.4    | 3.9    | -----  | 8.2    | 15.8   |
| Individual Hydrocarbons  | 83.6                                   | 23.3   | 4.3    | 153.9  | 88.3   | 17.9   | 7.5    | 219.8  |
| Organic Sulfides         | 0.13                                   | 0.06   | 0.02   | 0.18   | 0.14   | 0.07   | 0.02   | 0.09   |
| Organic Amines           | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Other Compounds          |                                        |        |        |        |        |        |        |        |
| Ammonia                  | 2.96                                   | 1.86   | 0.37   | 8.23   | 4.13   | 0.43   | 2.62   | 17.99  |
| Cyanide & Cyanogen       | 5.72                                   | 0.16   | 0.16   | 2.88   | 1.97   | 0.00   | 0.18   | 3.83   |
| DMMA                     | -----                                  | -----  | -----  | -----  | -----  | -----  | -----  | -----  |
| Hydrogen Sulfide         | 0.07                                   | 0.08   | 0.04   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Nickel Carbonyl          | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Nitrous Oxide            | 22.85                                  | 17.00  | 10.39  | 30.54  | 23.24  | 14.81  | 11.77  | 43.07  |
| Sulfur Dioxide           | ---                                    | ---    | ---    | ---    | ---    | ---    | ---    | ---    |

Table R-3B (Cont'd). Car 24, Fuel #2, Initial Mileage  
EMISSION RATE, MG/KM (Except as Noted)

| Test Number,<br>PNFST          | FTP    |        | SET    |        | HFET   |        | NYCC   |        | FTP    |        | SET    |        | HFET   |        | NYCC   |        |
|--------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|                                | 240211 | 240212 | 240212 | 240212 | 240213 | 240214 | 240214 | 240221 | 240221 | 240222 | 240222 | 240223 | 240223 | 240224 | 240224 | 240224 |
| <u>Aldehydes and Ketones</u>   |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |
| Formaldehyde                   | 5.12   | 0.96   | 0.00   | 0.00   | 3.51   | 1.30   | 0.00   | 3.77   | 4.90   | 0.00   | 0.00   | 8.21   | 11.12  | 4.64   | 0.00   | 0.00   |
| Acetaldehyde                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Acetone                        | 0.46   | 0.79   | 0.00   | 0.00   | 0.00   | 4.10   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Isobutyraldehyde               | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Methyl Ethyl Ketone            | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Crotonaldehyde                 | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Hexanaldehyde                  | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Benzaldehyde                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| <u>Aldehydes and Ketones</u>   | 5.6    | 1.8    | 0.00   | 0.00   | 3.8    | 5.4    | 0.00   | 3.9    | 8.2    | 0.00   | 0.00   | 8.2    | 15.8   | 5.6    | 0.00   | 0.00   |
| Total as % of THC,             | 3.5    | 6.0    | 0.00   | 0.00   | 38.0   | 2.2    | 0.00   | 2.3    | 82.0   | 0.00   | 0.00   | 82.0   | 5.6    | 0.00   | 0.00   | 0.00   |
| <u>Individual Hydrocarbons</u> |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |
| Methane                        | 57.77  | 20.56  | 0.00   | 0.00   | 3.75   | 133.26 | 0.00   | 59.17  | 16.61  | 0.00   | 0.00   | 7.16   | 187.25 | 1.74   | 0.00   | 0.00   |
| Ethylene                       | 4.15   | 0.68   | 0.00   | 0.00   | 0.00   | 1.56   | 0.00   | 5.17   | 0.21   | 0.00   | 0.00   | 0.03   | 1.74   | 0.00   | 0.00   | 0.00   |
| Ethane                         | 5.37   | 1.48   | 0.00   | 0.00   | 0.34   | 14.55  | 0.00   | 5.53   | 0.94   | 0.00   | 0.00   | 0.22   | 18.78  | 0.00   | 0.00   | 0.00   |
| Acetylene                      | 0.58   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 1.75   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Propane                        | 0.62   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.95   | 0.00   | 0.00   | 0.00   | 0.04   | 4.32   | 0.00   | 0.00   | 0.00   |
| Propylene                      | 1.27   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 2.25   | 0.00   | 0.00   | 0.00   | 0.04   | 2.20   | 0.00   | 0.00   | 0.00   |
| Benzene                        | 6.34   | 0.30   | 0.00   | 0.00   | 0.18   | 4.40   | 0.00   | 6.50   | 0.17   | 0.00   | 0.00   | 0.01   | 4.88   | 0.00   | 0.00   | 0.00   |
| Toluene                        | 7.50   | 0.30   | 0.00   | 0.00   | 0.03   | 0.08   | 0.00   | 7.02   | 0.00   | 0.00   | 0.00   | 0.00   | 0.66   | 0.00   | 0.00   | 0.00   |
| Total Individual HC            | 83.6   | 23.3   | 0.00   | 0.00   | 4.3    | 153.9  | 0.00   | 88.3   | 17.9   | 0.00   | 0.00   | 7.5    | 219.8  | 0.00   | 0.00   | 0.00   |
| Total as % of THC,             | 52.3   | 77.7   | 0.00   | 0.00   | 43.0   | 61.6   | 0.00   | 51.9   | 89.5   | 0.00   | 0.00   | 75.0   | 78.5   | 0.00   | 0.00   | 0.00   |
| <u>Organic Sulfides</u>        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |
| Carbonyl Sulfide               | 0.01   | 0.03   | 0.00   | 0.00   | 0.00   | 0.10   | 0.00   | 0.02   | 0.02   | 0.00   | 0.00   | 0.02   | 0.09   | 0.00   | 0.00   | 0.00   |
| Methyl Sulfide                 | 0.00   | 0.03   | 0.00   | 0.00   | 0.02   | 0.08   | 0.00   | 0.02   | 0.05   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Ethyl Sulfide                  | 0.11   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.09   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Methyl Disulfide               | 0.01   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.01   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| <u>Organic Amines</u>          |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |
| Monomethylamine                | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Dimethylamine                  | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Trimethylamine                 | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Diethylamine                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Triethylamine                  | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |



Table B-39. Car 24, Fuel #3, Initial Mileage

|                          | EMISSION RATE, MG/KM (Except as Noted) |        |        |        |        |        |        |        |
|--------------------------|----------------------------------------|--------|--------|--------|--------|--------|--------|--------|
|                          | FTP                                    | SET    | HFET   | NYCC   | FTP    | SET    | HFET   | NYCC   |
| Test Number, PVNFST      | 240311                                 | 240312 | 240313 | 240314 | 240321 | 240322 | 240323 | 240324 |
| Barometer, mm Hg         | 739.1                                  | 739.1  | 738.4  | 738.4  | 742.4  | 742.9  | 742.4  | 742.4  |
| Humidity, g/kg           | 11.4                                   | 10.5   | 9.8    | 8.9    | 9.7    | 9.7    | 10.2   | 8.4    |
| Temperature, °C          | 23.3                                   | 23.9   | 23.9   | 24.4   | 23.9   | 22.2   | 22.8   | 23.9   |
| Total Fuel Sulfur, mg/km | 36.76                                  | 27.73  | 24.98  | 66.53  | 36.81  | 27.52  | 25.17  | 66.85  |
| Carbon Dioxide, g/km     | 378.7                                  | 286.2  | 258.0  | 681.1  | 379.0  | 284.0  | 260.1  | 689.4  |
| Fuel Cons., g/100 km     | 16.22                                  | 12.24  | 11.02  | 29.36  | 16.25  | 12.14  | 11.11  | 29.50  |
| Regulated Emissions      |                                        |        |        |        |        |        |        |        |
| Hydrocarbons (THC), g/km | 0.12                                   | 0.03   | 0.02   | 0.39   | 0.11   | 0.03   | 0.02   | 0.22   |
| Carbon Monoxide, g/km    | 0.65                                   | 0.26   | 0.14   | 3.49   | 0.79   | 0.27   | 0.10   | 0.69   |
| Oxides of Nitrogen, g/km | 0.66                                   | 1.09   | 0.83   | 0.48   | 0.58   | 0.82   | 0.57   | 0.56   |
| Particulates             |                                        |        |        |        |        |        |        |        |
| Sulfate                  | 0.26                                   | 7.91   | 21.96  | 0.83   | 0.85   | 18.94  | 37.25  | 0.65   |
| Sulfate as % of TFS, %   | 0.24                                   | 9.51   | 29.30  | 0.42   | 0.77   | 22.94  | 49.33  | 0.32   |
| Compound Group Totals    |                                        |        |        |        |        |        |        |        |
| Aldehydes & Ketones      | 6.7                                    | 3.6    | 3.7    | 43.8   | 1.8    | 1.9    | 1.1    | 9.5    |
| Individual Hydrocarbons  | 67.2                                   | 27.0   | 12.7   | 179.2  | 78.9   | 28.3   | 16.0   | 169.9  |
| Organic Sulfides         | 0.25                                   | 0.06   | 0.11   | 0.24   | 0.07   | 0.01   | 0.04   | 0.39   |
| Organic Amines           | 0.06                                   | 0.02   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.43   |
| Other Compounds          |                                        |        |        |        |        |        |        |        |
| Ammonia                  | 1.66                                   | 0.91   | 2.83   | 10.20  | 2.57   | -----  | 5.23   | 21.46  |
| Cyanide & Cyanogen       | 4.09                                   | 0.11   | 0.19   | 2.38   | 0.69   | 0.08   | 0.10   | 3.35   |
| DMHA                     | -----                                  | -----  | -----  | -----  | -----  | -----  | -----  | -----  |
| Hydrogen Sulfide         | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Nickel Carbonyl          | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Nitrous Oxide            | 16.86                                  | 14.91  | 8.87   | 12.48  | 22.73  | 16.64  | 9.68   | 38.71  |
| Sulfur Dioxide           | --                                     | --     | --     | --     | --     | --     | --     | --     |

Table B-39 (Cont'd), Car 24, Fuel #3, Initial Mileage  
EMISSION RATE, MG/KM (Except as Noted)

| Test Number,<br>Aldehydes and Ketones | FWTST | 240311 |       |       | 240312 |     |     | 240313 |      |     | 240314 |      |      | 240321 |       |       | 240322 |     |     | 240323 |      |     | 240324 |      |      |
|---------------------------------------|-------|--------|-------|-------|--------|-----|-----|--------|------|-----|--------|------|------|--------|-------|-------|--------|-----|-----|--------|------|-----|--------|------|------|
|                                       |       | FTP    | SET   | HFET  | NYCC   | FTP | SET | HFET   | NYCC | FTP | SET    | HFET | NYCC | FTP    | SET   | HFET  | NYCC   | FTP | SET | HFET   | NYCC | FTP | SET    | HFET | NYCC |
| Formaldehyde                          |       | 5.28   | 3.18  | 2.88  | 24.73  |     |     |        |      |     |        |      |      | 1.67   | 1.91  | 1.07  | 2.40   |     |     |        |      |     |        |      |      |
| Acetaldehyde                          |       | 1.14   | 0.05  | 0.62  | 12.24  |     |     |        |      |     |        |      |      | 0.12   | 0.00  | 0.00  | 0.00   |     |     |        |      |     |        |      |      |
| Acetone                               |       | 0.30   | 0.00  | 0.22  | 6.81   |     |     |        |      |     |        |      |      | 0.00   | 0.00  | 0.00  | 0.00   |     |     |        |      |     |        |      |      |
| Isobutyraldehyde                      |       | 0.00   | 0.00  | 0.00  | 0.00   |     |     |        |      |     |        |      |      | 0.00   | 0.00  | 0.00  | 7.10   |     |     |        |      |     |        |      |      |
| Methyl Ethyl Ketone                   |       | 0.00   | 0.00  | 0.00  | 0.00   |     |     |        |      |     |        |      |      | 0.00   | 0.00  | 0.00  | 0.00   |     |     |        |      |     |        |      |      |
| Crotonaldehyde                        |       | 0.00   | 0.34  | 0.00  | 0.00   |     |     |        |      |     |        |      |      | 0.00   | 0.00  | 0.00  | 0.00   |     |     |        |      |     |        |      |      |
| Hexanaldehyde                         |       |        |       |       |        |     |     |        |      |     |        |      |      |        |       |       |        |     |     |        |      |     |        |      |      |
| Benzaldehyde                          |       |        |       |       |        |     |     |        |      |     |        |      |      |        |       |       |        |     |     |        |      |     |        |      |      |
| Aldehydes and Ketones                 |       | 6.7    | 3.6   | 3.7   | 43.8   |     |     |        |      |     |        |      |      | 1.8    | 1.9   | 1.1   | 9.5    |     |     |        |      |     |        |      |      |
| Total as % of THC,                    | %     | 5.6    | 12.0  | 18.5  | 11.2   |     |     |        |      |     |        |      |      | 1.6    | 6.3   | 5.5   | 4.3    |     |     |        |      |     |        |      |      |
| Individual Hydrocarbons               |       |        |       |       |        |     |     |        |      |     |        |      |      |        |       |       |        |     |     |        |      |     |        |      |      |
| Methane                               |       | 54.08  | 23.28 | 11.21 | 122.29 |     |     |        |      |     |        |      |      | 61.20  | 24.39 | 14.48 | 150.18 |     |     |        |      |     |        |      |      |
| Ethylene                              |       | 3.15   | 0.00  | 0.37  | 18.80  |     |     |        |      |     |        |      |      | 2.91   | 0.18  | 0.05  | 0.29   |     |     |        |      |     |        |      |      |
| Ethane                                |       | 6.06   | 2.30  | 1.04  | 13.94  |     |     |        |      |     |        |      |      | 7.60   | 2.85  | 1.52  | 18.57  |     |     |        |      |     |        |      |      |
| Acetylene                             |       | 0.76   | 0.00  | 0.00  | 0.00   |     |     |        |      |     |        |      |      | 0.56   | 0.00  | 0.00  | 0.00   |     |     |        |      |     |        |      |      |
| Propane                               | --    |        | 1.39  | 0.00  | 0.00   |     |     |        |      |     |        |      |      | 3.31   | 0.77  | 0.00  | 0.00   |     |     |        |      |     |        |      |      |
| Propylene                             |       | 1.43   | 0.00  | 0.00  | 12.81  |     |     |        |      |     |        |      |      | 1.64   | 0.00  | 0.00  | 0.54   |     |     |        |      |     |        |      |      |
| Benzene                               |       | 0.95   | 0.05  | 0.05  | 6.71   |     |     |        |      |     |        |      |      | 1.31   | 0.07  | 0.00  | 0.28   |     |     |        |      |     |        |      |      |
| Toluene                               |       | 0.74   | 0.00  | 0.00  | 4.68   |     |     |        |      |     |        |      |      | 0.41   | 0.00  | 0.00  | 0.03   |     |     |        |      |     |        |      |      |
| Total Individual HC                   |       | 67.2   | 27.0  | 12.7  | 179.2  |     |     |        |      |     |        |      |      | 78.9   | 28.3  | 16.0  | 169.9  |     |     |        |      |     |        |      |      |
| Total as % of THC,                    | %     | 56.0   | 90.0  | 63.5  | 45.9   |     |     |        |      |     |        |      |      | 71.7   | 94.3  | 80.0  | 77.2   |     |     |        |      |     |        |      |      |
| Organic Sulfides                      |       |        |       |       |        |     |     |        |      |     |        |      |      |        |       |       |        |     |     |        |      |     |        |      |      |
| Carbonyl Sulfide                      |       | 0.23   | 0.02  | 0.09  | 0.00   |     |     |        |      |     |        |      |      | 0.02   | 0.00  | 0.02  | 0.15   |     |     |        |      |     |        |      |      |
| Methyl Sulfide                        |       | 0.01   | 0.04  | 0.02  | 0.24   |     |     |        |      |     |        |      |      | 0.02   | 0.01  | 0.02  | 0.14   |     |     |        |      |     |        |      |      |
| Ethyl Sulfide                         |       | 0.01   | 0.00  | 0.00  | 0.00   |     |     |        |      |     |        |      |      | 0.03   | 0.00  | 0.00  | 0.04   |     |     |        |      |     |        |      |      |
| Methyl Disulfide                      |       | 0.00   | 0.00  | 0.00  | 0.00   |     |     |        |      |     |        |      |      | 0.00   | 0.00  | 0.00  | 0.06   |     |     |        |      |     |        |      |      |
| Organic Amines                        |       |        |       |       |        |     |     |        |      |     |        |      |      |        |       |       |        |     |     |        |      |     |        |      |      |
| Monomethylamine                       |       | 0.04   | 0.01  | 0.00  | 0.00   |     |     |        |      |     |        |      |      | 0.00   | 0.00  | 0.00  | 0.18   |     |     |        |      |     |        |      |      |
| Monocethylamine                       |       | 0.02   | 0.01  | 0.00  | 0.00   |     |     |        |      |     |        |      |      | 0.00   | 0.00  | 0.00  | 0.25   |     |     |        |      |     |        |      |      |
| Trimethylamine                        |       | 0.00   | 0.00  | 0.00  | 0.00   |     |     |        |      |     |        |      |      | 0.00   | 0.00  | 0.00  | 0.00   |     |     |        |      |     |        |      |      |
| Diethylamine                          |       | 0.00   | 0.00  | 0.00  | 0.00   |     |     |        |      |     |        |      |      | 0.00   | 0.00  | 0.00  | 0.00   |     |     |        |      |     |        |      |      |
| Triethylamine                         |       | 0.00   | 0.00  | 0.00  | 0.00   |     |     |        |      |     |        |      |      | 0.00   | 0.00  | 0.00  | 0.00   |     |     |        |      |     |        |      |      |

Table B-40. Car 24, Fuel No. 1, 5000 Miles

| Test Number,             | FWMFST<br>mm Hg<br>q/kg<br>°C | EMISSION RATE, MG/KM (Except as Noted) |        |        |        |        |        |        |        |
|--------------------------|-------------------------------|----------------------------------------|--------|--------|--------|--------|--------|--------|--------|
|                          |                               | FTP                                    | SET    | HFET   | NYCC   | FTP    | SET    | HFET   | NYCC   |
| Barometer,               |                               | 241111                                 | 241112 | 241113 | 241114 | 241121 | 241122 | 241123 | 241124 |
| Humidity,                |                               | 743.5                                  | 743.5  | 743.5  | 743.5  | 742.9  | 743.2  | 743.2  | 743.2  |
| Temperature,             |                               | 12.3                                   | 10.8   | 11.3   | 5.7    | 13.0   | 12.8   | 12.1   | 14.1   |
|                          |                               | 22.8                                   | 24.4   | 25.0   | 25.6   | 22.8   | 25.0   | 23.3   | 23.9   |
| Total Fuel Sulfur, mg/km |                               | 1.20                                   | 0.88   | 0.81   | 2.27   | 1.17   | 0.87   | 0.78   | 2.28   |
| Carbon Dioxide, g/km     |                               | 371.2                                  | 274.2  | 253.2  | 701.7  | 361.5  | 271.6  | 243.7  | 704.8  |
| Fuel Cons., l/100 km     |                               | 15.92                                  | 11.72  | 10.81  | 30.10  | 15.51  | 11.62  | 10.41  | 30.26  |
| Regulated Emissions      |                               |                                        |        |        |        |        |        |        |        |
| Hydrocarbons (THC), g/km |                               | 0.18                                   | 0.06   | 0.03   | 0.34   | 0.19   | 0.06   | 0.03   | 0.40   |
| Carbon Monoxide, g/km    |                               | 0.79                                   | 0.22   | 0.09   | 1.53   | 0.76   | 0.26   | 0.05   | 1.83   |
| Oxides of Nitrogen, g/km |                               | 0.86                                   | 0.88   | 0.72   | 0.49   | 0.75   | 0.83   | 0.69   | 0.72   |
| Particulates             |                               |                                        |        |        |        |        |        |        |        |
| Sulfate                  |                               | 0.22                                   | 0.13   | 0.45   | 0.45   | 0.50   | 0.13   | 0.34   | 0.25   |
| Sulfate as % of TFS, %   |                               | 6.11                                   | 4.92   | 18.52  | 6.61   | 14.25  | 4.98   | 14.53  | 3.65   |
| Compound Group Totals    |                               |                                        |        |        |        |        |        |        |        |
| Aldehydes & Ketones      |                               | 4.7                                    | 5.1    | 3.9    | 19.9   | 2.8    | 2.2    | 3.9    | 1.6    |
| Individual Hydrocarbons  |                               | 79.8                                   | 28.8   | 9.7    | 183.6  | 83.1   | 30.3   | 10.2   | 179.4  |
| Organic Sulfides         |                               | --                                     | 0.19   | 0.15   | 1.27   | 0.17   | 0.02   | 0.07   | 0.65   |
| Organic Amines           |                               | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.02   | 0.00   | 0.02   | 0.07   |
| Other Compounds          |                               |                                        |        |        |        |        |        |        |        |
| Ammonia                  |                               | 1.45                                   | 2.83   | 1.72   | 31.83  | 2.75   | 1.40   | 2.32   | 9.12   |
| Cyanide & Cyanogen       |                               | 0.00                                   | 0.00   | 0.04   | 0.54   | 0.26   | 0.21   | 0.09   | 1.12   |
| DMBA                     |                               | --                                     | --     | --     | --     | --     | --     | --     | --     |
| Hydrogen Sulfide         |                               | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Nickel Carbonyl          |                               | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Nitrous Oxide            |                               | 22.76                                  | 11.00  | 5.44   | 34.06  | 23.41  | 18.00  | 6.49   | 44.97  |
| Sulfur Dioxide           |                               | --                                     | --     | --     | --     | --     | --     | --     | --     |

Table B-4b (Cont'd). Car 24, Fuel No. 1, 5000 Miles  
EMISSION RATE, MG/KM (Except as Noted)

| Test Number,<br>Aldehydes and Ketones       | EMISSION RATE, MG/KM (Except as Noted) |              |             |               |              |              |
|---------------------------------------------|----------------------------------------|--------------|-------------|---------------|--------------|--------------|
|                                             | FTP                                    | SET          | HFET        | NYCC          | FTP          | SET          |
| Formaldehyde                                | 4.41                                   | 4.33         | 3.11        | 5.29          | 2.43         | 1.9          |
| Acetaldehyde                                | 0.21                                   | 0.15         | 0.40        | 1.77          | 0.04         | 0.02         |
| Acetone                                     | 0.00                                   | 0.61         | 0.15        | 0.57          | 0.00         | 0.00         |
| Isobutyraldehyde                            | 0.11                                   | 0.00         | 0.25        | 10.59         | 0.00         | 0.00         |
| Methyl Ethyl Ketone                         | 0.00                                   | 0.00         | 0.00        | 0.00          | 0.00         | 0.00         |
| Crotonaldehyde                              | --                                     | --           | --          | --            | --           | --           |
| Hexanaldehyde                               | 0.00                                   | 0.00         | 0.00        | 1.67          | 0.00         | 0.00         |
| Benzaldehyde                                | --                                     | --           | --          | --            | --           | --           |
| Aldehydes and Ketones<br>Total as % of THC, | 4.7<br>2.6                             | 5.1<br>8.5   | 3.9<br>13.0 | 19.9<br>5.9   | 2.8<br>1.5   | 2.2<br>3.7   |
| Individual hydrocarbons                     |                                        |              |             |               |              |              |
| Methane                                     | 56.03                                  | 25.88        | 8.72        | 155.02        | 59.57        | 26.07        |
| Ethylene                                    | 3.33                                   | 0.17         | 0.00        | 0.55          | 3.10         | 0.45         |
| Ethane                                      | 6.49                                   | 2.09         | 0.65        | 16.74         | 6.39         | 2.39         |
| Acetylene                                   | 0.92                                   | 0.00         | 0.00        | 0.00          | 0.59         | 0.00         |
| Propane                                     | 0.67                                   | 0.00         | 0.00        | 5.46          | 0.56         | 0.00         |
| Propylene                                   | 1.04                                   | 0.00         | 0.00        | 0.00          | 0.85         | 0.00         |
| Benzene                                     | 6.24                                   | 0.62         | 0.34        | 5.86          | 6.35         | 1.09         |
| Toluene                                     | 5.07                                   | 0.00         | 0.00        | 0.00          | 5.72         | 0.26         |
| Total Individual HC<br>Total as % of THC,   | 79.8<br>44.3                           | 28.8<br>48.0 | 9.7<br>32.3 | 183.6<br>54.0 | 83.1<br>43.7 | 30.3<br>50.5 |
| Organic Sulfides                            |                                        |              |             |               |              |              |
| Carbonyl Sulfide                            | --                                     | 0.08         | 0.09        | 0.88          | 0.05         | 0.01         |
| Methyl Sulfide                              | --                                     | 0.11         | 0.06        | 0.24          | 0.05         | 0.01         |
| Ethyl Sulfide                               | --                                     | 0.00         | 0.00        | 0.00          | 0.05         | 0.00         |
| Methyl Disulfide                            | --                                     | 0.00         | 0.00        | 0.15          | 0.02         | 0.00         |
| Organic Amines                              |                                        |              |             |               |              |              |
| Monomethylamine                             | 0.00                                   | 0.00         | 0.00        | 0.00          | 0.00         | 0.00         |
| Dimethylamine                               | 0.00                                   | 0.00         | 0.00        | 0.00          | 0.00         | 0.00         |
| Trimethylamine                              | 0.00                                   | 0.00         | 0.00        | 0.00          | 0.00         | 0.00         |
| Diethylamine                                | 0.00                                   | 0.00         | 0.00        | 0.00          | 0.00         | 0.00         |
| Triethylamine                               | 0.00                                   | 0.00         | 0.00        | 0.00          | 0.00         | 0.00         |

Table B-41. Car 24, Fuel No. 2, 5000 Miles

|                          | EMISSION RATE, MG/KM (Except as Noted) |        |        |        |        |        |        |        |
|--------------------------|----------------------------------------|--------|--------|--------|--------|--------|--------|--------|
|                          | FTP                                    | SET    | HFET   | NYCC   | FTP    | SET    | HFET   | NYCC   |
| Test Number, PMFST       | 241211                                 | 241212 | 241213 | 241214 | 241221 | 241222 | 241223 | 241224 |
| Barometer, mm Hg         | 738.9                                  | 739.4  | 739.4  | 739.4  | 738.4  | 737.6  | 737.6  | 737.6  |
| Humidity, g/kg           | 12.9                                   | 13.4   | 13.2   | 12.2   | 13.1   | 11.7   | 11.9   | 11.0   |
| Temperature, °C          | 25.0                                   | 25.6   | 26.1   | 26.7   | 22.8   | 26.1   | 25.6   | 27.8   |
| Total Fuel Sulfur, mg/km | 36.77                                  | 27.81  | 24.72  | 67.71  | 36.69  | 27.42  | 23.86  | 69.86  |
| Carbon Dioxide, g/km     | 378.9                                  | 287.9  | 256.1  | 699.0  | 377.9  | 283.7  | 247.2  | 720.9  |
| Fuel Cons., l/100 km     | 16.28                                  | 12.31  | 10.94  | 29.97  | 16.24  | 12.14  | 10.56  | 30.92  |
| Regulated Emissions      |                                        |        |        |        |        |        |        |        |
| Hydrocarbons (THC), g/km | 0.21                                   | 0.07   | 0.04   | 0.44   | 0.24   | 0.07   | 0.04   | 0.44   |
| Carbon Monoxide, g/km    | 1.13                                   | 0.22   | 0.08   | 1.20   | 1.20   | 0.24   | 0.06   | 1.39   |
| Oxides of Nitrogen, g/km | 0.87                                   | 0.93   | 0.91   | 0.73   | 0.85   | 0.95   | 0.85   | 0.77   |
| Particulates             |                                        |        |        |        |        |        |        |        |
| Sulfate                  | 2.17                                   | 27.40  | 40.97  | 1.21   | 3.99   | 24.86  | 43.18  | 2.22   |
| Sulfate as % of TFS, %   | 1.97                                   | 32.84  | 55.25  | 0.60   | 3.62   | 30.22  | 60.32  | 1.06   |
| Compound Group Totals    |                                        |        |        |        |        |        |        |        |
| Aldehydes & Ketones      | 3.4                                    | 3.6    | 2.1    | 3.9    | 2.2    | 3.2    | 5.3    | 17.1   |
| Individual Hydrocarbons  | 87.0                                   | 35.8   | 14.6   | 169.8  | 98.8   | 34.0   | 19.3   | 190.3  |
| Organic Sulfides         | 0.99                                   | 0.24   | 0.35   | 1.32   | 0.08   | 0.10   | 0.06   | 0.52   |
| Organic Amines           | 0.04                                   | 0.02   | 0.03   | 0.04   | 0.00   | 0.00   | 0.01   | 0.20   |
| Other Compounds          |                                        |        |        |        |        |        |        |        |
| Ammonia                  | 3.06                                   | 0.76   | 2.08   | 8.41   | 2.03   | 1.38   | 2.15   | 9.28   |
| Cyanide & Cyanogen       | 0.47                                   | 0.22   | 0.00   | 0.97   | 0.00   | 0.00   | 0.00   | 0.78   |
| Urea                     | --                                     | --     | --     | --     | --     | --     | --     | --     |
| Hydrogen Sulfide         | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Nickel Carbonyl          | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Nitrous Oxide            | 32.31                                  | 17.19  | 9.50   | 51.49  | 20.89  | 15.06  | 9.88   | 55.96  |
| Sulfur Dioxide           | --                                     | --     | --     | --     | --     | --     | --     | --     |

Table B-41 (Cont'd). Car 24, Fuel No. 2, 5000 Miles  
EMISSION RATE, MG/KM (Except as Noted)

| Test Number,<br>Aldehydes and Ketones | PMP/ST |       |       | NYCC   |       |       | NYCC  |       |       |
|---------------------------------------|--------|-------|-------|--------|-------|-------|-------|-------|-------|
|                                       | FTP    | SET   | HFET  | FTP    | SET   | HFET  | FTP   | SET   | HFET  |
| Formaldehyde                          | 2.90   | 3.29  | 1.66  | 2.90   | 2.02  | 3.19  | 2.02  | 3.19  | 4.86  |
| Acetaldehyde                          | 0.00   | 0.00  | 0.00  | 0.00   | 0.10  | 0.00  | 0.10  | 0.00  | 0.39  |
| Acetone                               | 0.00   | 0.00  | 0.00  | 0.00   | 0.11  | 0.00  | 0.11  | 0.00  | 0.00  |
| Isobutyraldehyde                      | 0.47   | 0.33  | 0.00  | 1.02   | 0.00  | 0.00  | 0.00  | 0.00  | 0.07  |
| Methyl Ethyl Ketone                   | 0.00   | 0.00  | 0.41  | 0.00   | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  |
| Crotonaldehyde                        | --     | --    | --    | --     | --    | --    | --    | --    | --    |
| Hexanaldehyde                         | 0.00   | 0.00  | 0.00  | 0.00   | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  |
| Benzaldehyde                          | --     | --    | --    | --     | --    | --    | --    | --    | --    |
| Aldehydes and Ketones                 | 3.4    | 3.6   | 2.1   | 3.9    | 2.2   | 3.2   | 2.2   | 3.2   | 5.3   |
| Total as % of THC,                    | 1.6    | 5.1   | 5.3   | 0.9    | 0.9   | 4.6   | 0.9   | 4.6   | 13.3  |
| Individual Hydrocarbons               |        |       |       |        |       |       |       |       |       |
| Methane                               | 60.00  | 29.58 | 12.62 | 142.91 | 63.15 | 28.70 | 63.15 | 28.70 | 17.35 |
| Ethylene                              | 4.84   | 0.50  | 0.00  | 1.60   | 5.52  | 0.40  | 5.52  | 0.40  | 0.01  |
| Ethane                                | 8.85   | 4.21  | 1.60  | 21.40  | 8.44  | 3.63  | 8.44  | 3.63  | 1.59  |
| Acetylene                             | 1.25   | 0.00  | 0.00  | 0.00   | 1.14  | 0.00  | 1.14  | 0.00  | 0.00  |
| Propane                               | 0.39   | 0.23  | 0.00  | 0.56   | 0.73  | 0.12  | 0.73  | 0.12  | 0.00  |
| Propylene                             | 1.29   | 0.00  | 0.00  | 0.00   | 1.79  | 0.00  | 1.79  | 0.00  | 0.00  |
| Benzene                               | 6.67   | 1.28  | 0.42  | 3.33   | 8.19  | 1.10  | 8.19  | 1.10  | 0.35  |
| Toluene                               | 3.72   | 0.00  | 0.00  | 0.00   | 9.82  | 0.00  | 9.82  | 0.00  | 0.00  |
| Total Individual HC                   | 87.0   | 35.8  | 14.6  | 169.8  | 98.8  | 34.0  | 98.8  | 34.0  | 19.3  |
| Total as % of THC,                    | 41.4   | 51.1  | 36.5  | 38.6   | 41.2  | 48.6  | 41.2  | 48.6  | 43.3  |
| Organic Sulfides                      |        |       |       |        |       |       |       |       |       |
| Carbonyl Sulfide                      | 0.72   | 0.04  | 0.19  | 0.29   | 0.06  | 0.06  | 0.06  | 0.06  | 0.06  |
| Methyl Sulfide                        | 0.24   | 0.19  | 0.08  | 0.39   | 0.00  | 0.04  | 0.00  | 0.04  | 0.00  |
| Ethyl Sulfide                         | 0.00   | 0.00  | 0.06  | 0.46   | 0.02  | 0.00  | 0.02  | 0.00  | 0.00  |
| Methyl disulfide                      | 0.03   | 0.01  | 0.02  | 0.18   | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  |
| Organic Amines                        |        |       |       |        |       |       |       |       |       |
| Monomethylamine                       | 0.01   | 0.00  | 0.00  | 0.00   | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  |
| Dimethylamine                         | 0.02   | 0.02  | 0.03  | 0.04   | 0.00  | 0.00  | 0.00  | 0.00  | 0.01  |
| Trimethylamine                        | 0.01   | 0.00  | 0.00  | 0.00   | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  |
| Diethylamine                          | 0.00   | 0.00  | 0.00  | 0.00   | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  |
| Triethylamine                         | 0.00   | 0.00  | 0.00  | 0.00   | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  |

Table B-42. Car 24, Fuel No. 3, 5,000 Miles

|                          | EMISSION RATE, MG/KM (Except as Noted) |        |        |        |        |        |        |        |
|--------------------------|----------------------------------------|--------|--------|--------|--------|--------|--------|--------|
|                          | FTP                                    | SET    | HFET   | NYCC   | FTP    | SET    | HFET   | NYCC   |
| Test Number, PWMT        | 241311                                 | 231312 | 241313 | 241314 | 241321 | 241322 | 241323 | 241324 |
| Barometer, mm Hg         | 740.2                                  | 740.2  | 746.3  | 740.2  | 746.3  | 746.3  | 746.3  | 746.3  |
| Humidity, g/kg           | 13.4                                   | 12.2   | 11.3   | 12.2   | 12.7   | 13.8   | 11.3   | 12.0   |
| Temperature, °C          | 23.9                                   | 26.7   | 26.7   | 26.7   | 23.3   | 24.4   | 26.7   | 26.7   |
| Total Fuel Sulfur, mg/km | 36.04                                  | 27.02  | 24.64  | 68.40  | 35.46  | 27.26  | 24.11  | 65.08  |
| Carbon Dioxide, g/km     | 370.9                                  | 278.8  | 253.4  | 703.8  | 365.1  | 281.4  | 248.3  | 671.4  |
| Fuel Cons., l/100 km     | 15.91                                  | 11.93  | 10.87  | 30.18  | 15.65  | 12.03  | 10.64  | 28.72  |
| Regulated Emissions      |                                        |        |        |        |        |        |        |        |
| Hydrocarbons (THC), g/km | 0.21                                   | 0.07   | 0.07   | 0.41   | 0.18   | 0.07   | 0.06   | 0.36   |
| Carbon Monoxide, g/km    | 0.69                                   | 0.24   | 0.71   | 1.35   | 0.64   | 0.15   | 0.51   | 0.21   |
| Oxides of Nitrogen, g/km | 0.75                                   | 0.53   | 0.38   | 0.66   | 0.76   | 0.70   | 0.37   | 0.67   |
| Particulates             |                                        |        |        |        |        |        |        |        |
| Sulfate                  | 0.53                                   | 12.80  | 15.91  | 0.72   | 0.52   | 22.24  | 20.09  | 0.52   |
| Sulfate as % of TTS, %   | 0.49                                   | 15.79  | 21.52  | 0.35   | 0.49   | 27.19  | 27.78  | 0.27   |
| Compound Group Totals    |                                        |        |        |        |        |        |        |        |
| Aldehydes & Ketones      | 2.6                                    | 2.0    | 3.9    | 12.0   | 5.7    | 3.6    | 0.4    | 17.4   |
| Individual Hydrocarbons  | 94.5                                   | 39.1   | 39.6   | 207.7  | 86.6   | 38.4   | 32.7   | 163.4  |
| Organic Sulfides         | 0.13                                   | 0.21   | --     | 1.52   | --     | --     | --     | --     |
| Organic Amines           | 0.03                                   | 0.01   | 0.00   | 0.29   | 0.01   | 0.01   | 0.00   | 0.08   |
| Other Compounds          |                                        |        |        |        |        |        |        |        |
| Ammonia                  | 3.45                                   | 6.40   | 3.83   | 22.59  | 2.13   | 0.48   | 1.12   | 15.78  |
| Cyanide & Cyanogen       | 0.19                                   | 0.20   | 1.27   | 1.23   | 1.15   | 0.31   | 0.31   | 1.87   |
| DMQA                     | --                                     | --     | --     | --     | --     | --     | --     | --     |
| Hydrogen Sulfide         | 0.00                                   | 0.00   | 0.17   | 0.00   | 0.00   | 0.00   | 0.25   | 0.00   |
| Nickel Carbonyl          | --                                     | --     | 0.00   | --     | 0.00   | 0.00   | 0.00   | 0.00   |
| Nitrous Oxide            | --                                     | --     | 9.78   | 45.63  | 21.43  | 10.54  | 9.61   | 33.96  |
| Sulfur Dioxide           | 17.38                                  | 15.50  | --     | --     | --     | --     | --     | --     |



Table B-42 (Cont'd). Car 24, Fuel No. 3, 5,000 Miles

| Test Number,            | PVNFST | EMISSION RATE, MG/KM (Except as Noted) |        |        |        |        |        |
|-------------------------|--------|----------------------------------------|--------|--------|--------|--------|--------|
|                         |        | FTP                                    | SET    | HFET   | NYCC   | FTP    | SET    |
| Aldehydes and Ketones   | 241311 | 241312                                 | 241313 | 241314 | 241321 | 241322 | 241323 |
| Formaldehyde            | 1.99   | 0.42                                   | 0.41   | 0.00   | 5.63   | 2.70   | 0.30   |
| Acetaldehyde            | 0.00   | 0.00                                   | 0.25   | 0.00   | 0.10   | 0.36   | 0.12   |
| Acetone                 | 0.00   | 0.00                                   | 3.21   | 0.00   | 0.00   | 0.57   | 0.00   |
| Isobutyraldehyde        | 0.58   | 1.54                                   | 0.00   | 11.97  | 0.00   | 0.00   | 0.00   |
| Methyl Ethyl Ketone     | 0.00   | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Crotonaldehyde          | --     | --                                     | --     | --     | --     | --     | --     |
| Hexanaldehyde           | 0.00   | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Benzaldehyde            | --     | --                                     | --     | --     | --     | --     | --     |
| Aldehydes and Ketones   | 2.6    | 2.0                                    | 3.9    | 12.0   | 5.7    | 3.6    | 0.4    |
| Total as % of THC,      | 1.2    | 2.9                                    | 5.6    | 2.9    | 3.2    | 5.1    | 0.7    |
| Individual Hydrocarbons |        |                                        |        |        |        |        |        |
| Methane                 | 72.86  | 34.10                                  | 30.88  | 147.06 | 69.76  | 33.97  | 27.14  |
| Ethylene                | 3.82   | 0.17                                   | 1.63   | 12.72  | 2.81   | 0.06   | 0.93   |
| Ethane                  | 9.64   | 4.17                                   | 4.14   | 21.63  | 9.42   | 4.19   | 3.48   |
| Acetylene               | 2.86   | 0.00                                   | 0.00   | 0.00   | 1.35   | 0.00   | 0.00   |
| Propane                 | 0.49   | 0.12                                   | 0.64   | 7.54   | 0.13   | 0.00   | 0.08   |
| Propylene               | 1.84   | 0.00                                   | 0.69   | 6.64   | 1.41   | 0.00   | 0.16   |
| Benzene                 | 2.23   | 0.52                                   | 1.59   | 8.22   | 1.33   | 0.21   | 0.79   |
| Toluene                 | 0.80   | 0.00                                   | 0.00   | 3.89   | 0.40   | 0.00   | 0.08   |
| Total Individual HC     | 94.5   | 39.1                                   | 39.6   | 207.7  | 86.6   | 38.4   | 32.7   |
| Total as % of THC,      | 45.0   | 55.9                                   | 56.6   | 50.7   | 48.1   | 54.9   | 54.5   |
| Organic Sulfides        |        |                                        |        |        |        |        |        |
| Carbonyl Sulfide        | 0.10   | 0.11                                   | --     | 0.35   | --     | --     | --     |
| Methyl Sulfide          | 0.02   | 0.09                                   | --     | 0.31   | --     | --     | --     |
| Ethyl Sulfide           | 0.00   | 0.00                                   | --     | 0.62   | --     | --     | --     |
| Methyl Disulfide        | 0.01   | 0.01                                   | --     | 0.24   | --     | --     | --     |
| Organic Amines          |        |                                        |        |        |        |        |        |
| Monomethylamine         | 0.00   | 0.00                                   | 0.00   | 0.05   | 0.00   | 0.00   | 0.00   |
| Dimethylamine           | 0.03   | 0.01                                   | 0.00   | 0.24   | 0.01   | 0.01   | 0.08   |
| Trimethylamine          | 0.00   | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Diethylamine            | 0.00   | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Triethylamine           | 0.00   | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |

Table B-43. CAR 24, FUEL NO. 1, 10,000 MILES

|                          | EMISSION RATE, MG/KM (Except as Noted) |        |        |        |        |        |        |        |
|--------------------------|----------------------------------------|--------|--------|--------|--------|--------|--------|--------|
|                          | FTP                                    | SET    | HFET   | NYCC   | FTP    | SET    | HFET   | NYCC   |
| Test Number, PUMPST      | 242111                                 | 242112 | 242113 | 242114 | 242121 | 242122 | 242123 | 242124 |
| Barometer, mm Hg         | 742.9                                  | 743.2  | 743.2  | 742.9  | 744.7  | 744.7  | 744.7  | 744.7  |
| Humidity, q/kg           | 11.1                                   | 11.8   | 12.1   | 12.1   | 14.1   | 13.3   | 13.9   | 13.6   |
| Temperature, °C          | 23.9                                   | 25.6   | 26.7   | 26.7   | 23.9   | 25.6   | 26.1   | 26.7   |
| Total Fuel Sulfur, mg/km | 1.19                                   | 0.91   | 0.81   | 2.27   | 1.20   | 0.90   | 0.81   | 2.35   |
| Carbon Dioxide, g/km     | 367.6                                  | 283.6  | 250.7  | 704.1  | 370.2  | 280.8  | 250.7  | 729.2  |
| Fuel Cons., l/100 km     | 15.78                                  | 12.13  | 10.71  | 30.16  | 15.91  | 12.01  | 10.71  | 31.24  |
| Regulated Emissions      |                                        |        |        |        |        |        |        |        |
| Hydrocarbons (THC), g/km | 0.18                                   | 0.07   | 0.03   | 0.39   | 0.20   | 0.06   | 0.02   | 0.37   |
| Carbon Monoxide, g/km    | 0.93                                   | 0.29   | 0.03   | 0.87   | 1.15   | 0.27   | 0.03   | 0.92   |
| Oxides of Nitrogen, g/km | 1.01                                   | 1.33   | 1.25   | 1.17   | 1.04   | 1.25   | 1.36   | 1.16   |
| Particulates             |                                        |        |        |        |        |        |        |        |
| Sulfate                  | 0.20                                   | 0.11   | 0.17   | 0.25   | 0.19   | 0.17   | 0.53   | 0.04   |
| Sulfate as % of TFS, %   | 5.60                                   | 4.03   | 7.00   | 3.67   | 5.28   | 6.30   | 21.81  | 0.57   |
| Compound Group Totals    |                                        |        |        |        |        |        |        |        |
| Aldehydes & Ketones      | 3.9                                    | 4.4    | 3.1    | 36.1   | 4.2    | 5.7    | 8.1    | 19.3   |
| Individual Hydrocarbons  | 92.1                                   | 37.5   | 14.3   | 183.8  | 93.6   | 39.2   | 13.4   | 194.4  |
| Organic Sulfides         | 0.97                                   | 0.01   | 0.24   | 14.21  | 0.96   | 0.26   | 0.23   | 4.28   |
| Organic Amines           | 0.02                                   | 0.01   | 0.00   | 0.18   | 0.01   | 0.01   | 0.03   | 0.25   |
| Other Compounds          |                                        |        |        |        |        |        |        |        |
| Ammonia                  | 2.05                                   | 0.97   | 1.12   | 11.67  | 1.68   | 1.13   | 1.20   | 13.65  |
| Cyanide & Cyanogen       | 0.59                                   | 0.07   | 0.21   | 4.14   | 0.98   | 0.34   | 0.26   | 3.42   |
| DMNA                     | --                                     | --     | --     | --     | --     | --     | --     | --     |
| Hydrogen Sulfide         | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Nickel Carbonyl          | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Nitrous Oxide            | 33.35                                  | 18.22  | 9.84   | 71.63  | 22.72  | 13.83  | 7.78   | 88.73  |
| Sulfur Dioxide           | --                                     | --     | --     | --     | --     | --     | --     | --     |

Table B-43 (Cont'd). CAR 24, FUEL No. 1, 10,000 MILES

| Test Number, PMFEST                      | EMISSION RATE, MG/KM (Except as Noted) |            |             |             |            |            |             |             |
|------------------------------------------|----------------------------------------|------------|-------------|-------------|------------|------------|-------------|-------------|
|                                          | FTP                                    | SET        | HFET        | NYCC        | FTP        | SET        | HFET        | NYCC        |
| Aldehydes and Ketones                    | 242111                                 | 242112     | 242113      | 242114      | 242121     | 242122     | 242123      | 242124      |
| Formaldehyde                             | 1.60                                   | 4.21       | 2.88        | 0.00        | 2.48       | 5.56       | 6.34        | 7.16        |
| Acetaldehyde                             | 0.07                                   | 0.18       | 0.00        | 0.00        | 0.40       | 0.15       | 0.34        | 0.88        |
| Acetone                                  | 0.00                                   | 0.00       | 0.00        | 0.00        | 0.00       | 0.00       | 0.07        | 0.00        |
| Isobutyraldehyde                         | 2.25                                   | 0.00       | 0.24        | 36.08       | 1.35       | 0.00       | 1.33        | 11.30       |
| Methyl Ethyl Ketone                      | 0.00                                   | 0.00       | 0.00        | 0.00        | 0.00       | 0.00       | 0.00        | 0.00        |
| Crotonaldehyde                           | --                                     | --         | --          | --          | --         | --         | --          | --          |
| Hexanaldehyde                            | 0.00                                   | 0.00       | 0.00        | 0.00        | 0.00       | 0.00       | 0.00        | 0.00        |
| Benzaldehyde                             | --                                     | --         | --          | --          | --         | --         | --          | --          |
| Aldehydes and Ketones Total as % of THC, | 3.9<br>2.2                             | 4.4<br>6.3 | 3.1<br>10.3 | 36.1<br>9.3 | 4.2<br>2.1 | 5.7<br>9.5 | 8.1<br>40.5 | 19.3<br>5.2 |
| Individual Hydrocarbons                  | 68.78                                  | 32.10      | 12.35       | 146.25      | 66.12      | 33.40      | 11.82       | 163.04      |
| Methane                                  | 4.01                                   | 0.87       | 0.08        | 4.51        | 4.56       | 0.44       | 0.04        | 4.20        |
| Ethylene                                 | 8.51                                   | 3.38       | 1.45        | 21.90       | 8.12       | 3.88       | 1.14        | 23.46       |
| Ethane                                   | 1.01                                   | 0.00       | 0.00        | 0.00        | 1.35       | 0.00       | 0.00        | 0.00        |
| Acetylene                                | 0.84                                   | 0.00       | 0.00        | 2.78        | 0.00       | 0.02       | 0.00        | 0.00        |
| Propane                                  | 0.90                                   | 0.00       | 0.00        | 0.00        | 1.25       | 0.00       | 0.00        | 0.00        |
| Propylene                                | 3.68                                   | 1.11       | 0.37        | 8.38        | 6.66       | 1.42       | 0.40        | 3.73        |
| Benzene                                  | 4.32                                   | 0.00       | 0.00        | 0.00        | 5.54       | 0.00       | 0.00        | 0.00        |
| Toluene                                  | 92.1                                   | 37.5       | 14.3        | 183.8       | 93.6       | 39.2       | 13.4        | 194.4       |
| Total Individual HC Total as % of THC,   | 51.2                                   | 53.6       | 47.7        | 47.1        | 46.8       | 65.3       | 67.0        | 52.5        |
| Organic Sulfides                         | 0.93                                   | 0.01       | 0.20        | 14.16       | 0.93       | 0.26       | 0.23        | 4.11        |
| Carbonyl Sulfide                         | 0.04                                   | 0.00       | 0.04        | 0.05        | 0.01       | 0.00       | 0.00        | 0.17        |
| Methyl Sulfide                           | 0.00                                   | 0.00       | 0.00        | 0.00        | 0.01       | 0.00       | 0.00        | 0.00        |
| Ethyl Sulfide                            | 0.00                                   | 0.00       | 0.00        | 0.00        | 0.01       | 0.00       | 0.00        | 0.00        |
| Methyl Disulfide                         | 0.00                                   | 0.00       | 0.00        | 0.00        | 0.00       | 0.00       | 0.00        | 0.00        |
| Organic Amines                           | 0.01                                   | 0.00       | 0.00        | 0.00        | 0.00       | 0.00       | 0.01        | 0.15        |
| Monomethylamine                          | 0.01                                   | 0.01       | 0.00        | 0.18        | 0.01       | 0.01       | 0.02        | 0.10        |
| Dimethylamine                            | 0.00                                   | 0.00       | 0.00        | 0.00        | 0.00       | 0.00       | 0.00        | 0.00        |
| Trimethylamine                           | 0.00                                   | 0.00       | 0.00        | 0.00        | 0.00       | 0.00       | 0.00        | 0.00        |
| Diethylamine                             | 0.00                                   | 0.00       | 0.00        | 0.00        | 0.00       | 0.00       | 0.00        | 0.00        |
| Triethylamine                            | 0.00                                   | 0.00       | 0.00        | 0.00        | 0.00       | 0.00       | 0.00        | 0.00        |

Table B-44. CAR 24, FUEL NO. 2, 10,000 MILES

|                          | EMISSION RATE, MG/KM (Except as Noted) |        |        |        |        |        |        |        |
|--------------------------|----------------------------------------|--------|--------|--------|--------|--------|--------|--------|
|                          | FTP                                    | SET    | HFET   | NYCC   | FTP    | SET    | HFET   | NYCC   |
| Test Number, PUMPST      | 242211                                 | 242212 | 242213 | 242214 | 242221 | 242222 | 242223 | 242224 |
| Barometer, mm Hg         | 745.5                                  | 745.5  | 745.5  | 744.7  | 744.5  | 744.7  | 744.7  | 744.7  |
| Humidity, g/kg           | 14.6                                   | 13.1   | 13.4   | 13.4   | 12.8   | 8.7    | 13.1   | 13.6   |
| Temperature, °C          | 24.4                                   | 26.1   | 27.2   | 27.2   | 23.3   | 26.1   | 27.8   | 26.7   |
| Total Fuel Sulfur, mg/km | 35.50                                  | 26.07  | 23.15  | 67.34  | 35.21  | 26.86  | 23.52  | 68.95  |
| Carbon Dioxide, g/km     | 365.6                                  | 269.9  | 239.9  | 695.3  | 362.9  | 277.9  | 243.8  | 712.4  |
| Fuel Cons., g/100 km     | 15.72                                  | 11.54  | 10.25  | 29.81  | 15.59  | 11.89  | 10.41  | 30.52  |
| Regulated Emissions      |                                        |        |        |        |        |        |        |        |
| Hydrocarbons (THC), g/km | 0.22                                   | 0.07   | 0.03   | 0.41   | 0.22   | 0.07   | 0.03   | 0.37   |
| Carbon Monoxide, g/km    | 1.27                                   | 0.16   | 0.02   | 1.13   | 1.07   | 0.30   | 0.02   | 0.96   |
| Oxides of Nitrogen, g/km | 1.11                                   | 1.22   | 1.21   | 1.17   | 1.09   | 1.08   | 1.16   | 1.18   |
| Particulates             |                                        |        |        |        |        |        |        |        |
| Sulfate                  | 0.49                                   | 19.67  | 34.78  | 0.50   | 4.71   | 22.43  | 42.42  | 1.43   |
| Sulfate as % of TFS, %   | 0.46                                   | 25.15  | 50.08  | 0.25   | 4.46   | 32.04  | 60.12  | 0.69   |
| Compound Group Totals    |                                        |        |        |        |        |        |        |        |
| Aldehydes & Ketones      | 4.9                                    | 3.3    | 3.6    | 30.5   | 7.3    | 3.5    | 5.4    | 56.5   |
| Individual Hydrocarbons  | 102.2                                  | 37.7   | 17.7   | 185.9  | 103.2  | 39.3   | 18.7   | 188.9  |
| Organic Sulfides         | 0.56                                   | 0.43   | 0.26   | 0.00   | 0.31   | 0.06   | 0.00   | 0.00   |
| Organic Amines           | 0.03                                   | 0.01   | 0.02   | 0.59   | 0.02   | 0.05   | 0.02   | 0.26   |
| Other Compounds          |                                        |        |        |        |        |        |        |        |
| Ammonia                  | 1.40                                   | 0.66   | 0.59   | 10.68  | 1.31   | 1.08   | 0.62   | 14.29  |
| Cyanide & Cyanogen       | 0.35                                   | 0.20   | 0.12   | 3.29   | 0.11   | 0.00   | 0.15   | 2.06   |
| DMVA                     | --                                     | --     | --     | --     | --     | --     | --     | --     |
| Hydrogen Sulfide         | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Nickel Carbonyl          | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Nitrous Oxide            | 31.44                                  | 18.18  | 13.19  | 93.36  | 29.94  | 18.67  | 10.81  | 74.51  |
| Sulfur Dioxide           | --                                     | --     | --     | --     | --     | --     | --     | --     |

Table B-45 (Cont'd). CAR 24, FUEL NO. 2, 10,000 MILES

|                         |        | EMISSION RATE, MG/KM (Except as Noted) |        |        |        |        |        |        |        |
|-------------------------|--------|----------------------------------------|--------|--------|--------|--------|--------|--------|--------|
|                         |        | FTP                                    | SET    | HFET   | NYCC   | FTP    | SET    | HFET   | NYCC   |
| Test Number,            | PVHFST | 242211                                 | 242212 | 242213 | 242214 | 242221 | 242222 | 242223 | 142224 |
| Aldehydes and Ketones   |        |                                        |        |        |        |        |        |        |        |
| Formaldehyde            |        | 3.01                                   | 2.49   | 2.90   | 0.00   | 3.80   | 3.44   | 2.83   | 0.97   |
| Acetaldehyde            |        | 0.43                                   | 0.35   | 0.26   | 1.83   | 0.64   | 0.00   | 0.33   | 0.00   |
| Acetone                 |        | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Isobutyraldehyde        |        | 1.50                                   | 0.46   | 0.43   | 28.64  | 2.83   | 1.10   | 2.22   | 55.57  |
| Methyl Ethyl Ketone     |        | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Crotonaldehyde          |        | --                                     | --     | --     | --     | --     | --     | --     | --     |
| Hexanaldehyde           |        | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Benzaldehyde            |        | --                                     | --     | --     | --     | --     | --     | --     | --     |
| Aldehydes and Ketones   |        | 4.9                                    | 3.3    | 3.6    | 30.5   | 7.3    | 3.5    | 5.4    | 56.5   |
| Total as % of THC,      |        | 2.2                                    | 4.7    | 12.0   | 7.4    | 3.3    | 5.0    | 18.0   | 15.3   |
| Individual Hydrocarbons |        |                                        |        |        |        |        |        |        |        |
| Methane                 |        | 69.24                                  | 31.34  | 15.33  | 147.43 | 62.31  | 32.67  | 16.16  | 140.5  |
| Ethylene                |        | 6.19                                   | 0.77   | 0.08   | 6.92   | 4.93   | 1.07   | 0.17   | 7.40   |
| Ethane                  |        | 9.17                                   | 4.42   | 2.05   | 23.98  | 8.55   | 4.39   | 2.08   | 28.44  |
| Acetylene               |        | 1.31                                   | 0.00   | 0.00   | 0.00   | 2.23   | 0.00   | 0.00   | 0.00   |
| Propane                 |        | 0.32                                   | 0.06   | 0.00   | 1.16   | 0.31   | 0.12   | 0.00   | 2.29   |
| Propylene               |        | 1.49                                   | 0.00   | 0.00   | 0.00   | 1.12   | 0.01   | 0.00   | 0.00   |
| Benzene                 |        | 7.96                                   | 1.13   | 0.27   | 6.43   | 9.68   | 0.99   | 0.27   | 9.67   |
| Toluene                 |        | 6.48                                   | 0.00   | 0.01   | 0.00   | 14.02  | 0.00   | 0.00   | 0.53   |
| Total Individual HC     |        | 102.2                                  | 37.7   | 17.7   | 185.9  | 103.2  | 39.3   | 18.7   | 188.9  |
| Total as % of THC,      |        | 46.5                                   | 53.9   | 59.0   | 45.3   | 46.9   | 56.1   | 62.3   | 51.1   |
| Organic Sulfides        |        |                                        |        |        |        |        |        |        |        |
| Carbonyl Sulfide        |        | 0.49                                   | 0.40   | 0.25   | 0.00   | 0.30   | 0.04   | 0.00   | 0.00   |
| Methyl Sulfide          |        | 0.05                                   | 0.03   | 0.01   | 0.00   | 0.00   | 0.02   | 0.00   | 0.00   |
| Ethyl Sulfide           |        | 0.02                                   | 0.00   | 0.00   | 0.00   | 0.01   | 0.00   | 0.00   | 0.00   |
| Methyl Disulfide        |        | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Organic Amines          |        |                                        |        |        |        |        |        |        |        |
| Monomethylamine         |        | 0.01                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.02   | 0.00   | 0.00   |
| Monomethylamine         |        | 0.02                                   | 0.01   | 0.02   | 0.59   | 0.02   | 0.03   | 0.02   | 0.26   |
| Trimethylamine          |        | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Diethylamine            |        | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Triethylamine           |        | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |

Table B-45. CAR 24, FUEL NO. 3, 10,000 MILES

|                          | EMISSION RATE, MG/KM (Except as Noted) |        |        |        |        |        |        |        |
|--------------------------|----------------------------------------|--------|--------|--------|--------|--------|--------|--------|
|                          | FTP                                    | SET    | HFET   | NYCC   | FTP    | SET    | HFET   | NYCC   |
| Test Number, PUMFST      | 242311                                 | 242312 | 242313 | 242314 | 242321 | 242322 | 242323 | 242324 |
| Barometer, mm Hg         | 742.2                                  | 742.7  | 742.7  | 742.7  | 740.7  | 743.2  | 743.2  | 743.2  |
| Humidity, g/kg           | 13.1                                   | 13.7   | 14.0   | 13.2   | 12.6   | 12.3   | 12.4   | 13.4   |
| Temperature, °C          | 24.4                                   | 26.7   | 27.8   | 27.8   | 25.6   | 26.1   | 27.8   | 27.2   |
| Total Fuel Sulfur, mg/km | 34.56                                  | 25.68  | 23.30  | 65.76  | 33.57  | 26.26  | 23.21  | 66.40  |
| Carbon Dioxide, g/km     | 354.7                                  | 264.9  | 240.7  | 677.9  | 344.8  | 271.1  | 239.2  | 685.0  |
| Fuel Cons., g/100 km     | 15.25                                  | 11.33  | 10.28  | 29.02  | 14.81  | 11.59  | 10.24  | 29.30  |
| Regulated Emissions      |                                        |        |        |        |        |        |        |        |
| Hydrocarbons (THC), g/km | 0.20                                   | 0.06   | 0.03   | 0.25   | 0.19   | 0.06   | 0.04   | 0.27   |
| Carbon Monoxide, g/km    | 1.26                                   | 0.26   | 0.07   | 0.79   | 1.04   | 0.13   | 0.41   | 0.47   |
| Oxides of Nitrogen, g/km | 0.88                                   | 0.94   | 0.79   | 1.00   | 0.91   | 0.96   | 0.50   | 1.21   |
| Particulates             |                                        |        |        |        |        |        |        |        |
| Sulfate                  | 0.28                                   | 17.08  | 19.13  | 0.30   | 0.64   | 15.03  | 18.90  | 0.09   |
| Sulfate as % of TFS, %   | 0.27                                   | 22.17  | 27.37  | 0.15   | 0.64   | 19.08  | 27.14  | 0.05   |
| Compound Group Totals    |                                        |        |        |        |        |        |        |        |
| Aldehydes & Ketones      | 4.3                                    | 1.5    | 4.3    | 50.4   | 5.1    | 3.8    | 1.4    | 33.3   |
| Individual Hydrocarbons  | 101.0                                  | 39.3   | 22.0   | 169.0  | 93.9   | 38.6   | 26.1   | 169.8  |
| Organic Sulfides         | 1.26                                   | 0.08   | 0.22   | 9.92   | 0.02   | 0.11   | 0.11   | 1.40   |
| Organic Amines           | 0.03                                   | 0.01   | 0.01   | 0.01   | --     | 0.00   | 0.03   | 0.15   |
| Other Compounds          |                                        |        |        |        |        |        |        |        |
| Ammonia                  | 1.41                                   | 0.53   | 0.91   | 6.54   | 3.55   | 0.53   | 1.18   | 7.49   |
| Cyanide & Cyanogen       | 0.69                                   | 0.04   | 0.12   | 1.30   | 0.17   | 0.07   | 0.14   | 2.07   |
| DINA                     | --                                     | --     | --     | --     | --     | --     | --     | --     |
| Hydrogen Sulfide         | 0.00                                   | 0.00   | 0.00   | 0.00   | --     | 0.00   | 0.00   | 0.00   |
| Nickel Carbonyl          | 0.00                                   | 0.00   | 0.00   | 0.00   | --     | 0.00   | 0.00   | 0.00   |
| Nitrous Oxide            | 32.35                                  | 16.14  | 9.32   | 63.35  | 27.23  | 19.50  | 14.57  | 60.37  |
| Sulfur Dioxide           | --                                     | --     | --     | --     | --     | --     | --     | --     |

Table B-45 (Cont'd). CAR 24, FUEL NO. 3, 10,000 MILES

| Test Number,<br>Aldehydes and Ketones       | EMISSION RATE, MG/KM (Except as Noted) |              |              |               |              |              |              |               |
|---------------------------------------------|----------------------------------------|--------------|--------------|---------------|--------------|--------------|--------------|---------------|
|                                             | FTP                                    | SET          | HFET         | NYCC          | FTP          | SET          | HFET         | NYCC          |
| PVMPST 242311                               | 242312                                 | 242313       | 242314       | 242321        | 242322       | 242323       | 242324       |               |
| Formaldehyde                                | 3.93                                   | 1.49         | 1.44         | 3.40          | 5.07         | 3.77         | 0.70         | 2.57          |
| Acetaldehyde                                | 0.40                                   | 0.00         | 0.11         | 0.00          | 0.00         | 0.06         | 0.00         | 0.00          |
| Acetone                                     | 0.00                                   | 0.00         | 0.00         | 0.00          | 0.00         | 0.00         | 0.00         | 0.00          |
| Isobutyraldehyde                            | 0.00                                   | 0.00         | 2.86         | 46.96         | 0.00         | 0.00         | 0.73         | 30.75         |
| Methyl Ethyl Ketone                         | 0.00                                   | 0.00         | 0.00         | 0.00          | 0.00         | 0.00         | 0.00         | 0.00          |
| Crotonaldehyde                              | --                                     | --           | --           | --            | --           | --           | --           | --            |
| Hexanaldehyde                               | 0.00                                   | 0.00         | 0.00         | 0.00          | 0.00         | 0.00         | 0.00         | 0.00          |
| Benzaldehyde                                | --                                     | --           | --           | --            | --           | --           | --           | --            |
| Aldehydes and Ketones<br>Total as % of THC, | 4.3<br>2.2                             | 1.5<br>2.5   | 4.3<br>14.3  | 50.4<br>20.2  | 5.1<br>2.7   | 3.8<br>6.3   | 1.4<br>3.5   | 33.3<br>12.3  |
| Individual Hydrocarbons                     |                                        |              |              |               |              |              |              |               |
| Methane                                     | 73.59                                  | 33.70        | 19.28        | 142.94        | 71.50        | 33.46        | 21.36        | 145.53        |
| Ethylene                                    | 5.40                                   | 0.22         | 0.04         | 0.27          | 4.57         | 0.28         | 0.93         | 0.27          |
| Ethane                                      | 10.83                                  | 4.83         | 2.46         | 22.80         | 10.37        | 4.69         | 2.67         | 22.68         |
| Acetylene                                   | 2.78                                   | 0.00         | 0.00         | 0.00          | 1.78         | 0.00         | 0.00         | 0.00          |
| Propane                                     | 0.67                                   | 0.06         | 0.04         | 2.26          | 0.49         | 0.06         | 0.08         | 0.84          |
| Propylene                                   | 2.24                                   | 0.00         | 0.00         | 0.00          | 1.94         | 0.00         | 0.52         | 0.00          |
| Benzene                                     | 3.01                                   | 0.51         | 0.15         | 0.75          | 2.01         | 0.15         | 0.56         | 0.50          |
| Toluene                                     | 2.44                                   | 0.00         | 0.00         | 0.00          | 1.21         | 0.00         | 0.00         | 0.00          |
| Total Individual HC<br>Total as % of THC,   | 101.0<br>50.5                          | 39.3<br>65.5 | 22.0<br>73.3 | 169.0<br>67.6 | 93.9<br>49.4 | 38.6<br>64.3 | 26.1<br>65.3 | 169.8<br>62.9 |
| Organic Sulfides                            |                                        |              |              |               |              |              |              |               |
| Carbonyl Sulfide                            | 1.22                                   | 0.05         | 0.17         | 8.89          | 0.00         | 0.11         | 0.08         | 1.12          |
| Methyl Sulfide                              | 0.04                                   | 0.03         | 0.05         | 0.77          | 0.00         | 0.00         | 0.02         | 0.00          |
| Ethyl Sulfide                               | 0.00                                   | 0.00         | 0.00         | 0.16          | 0.02         | 0.00         | 0.00         | 0.22          |
| Methyl Disulfide                            | 0.00                                   | 0.00         | 0.00         | 0.10          | 0.00         | 0.00         | 0.01         | 0.06          |
| Organic Amines                              |                                        |              |              |               |              |              |              |               |
| Monomethylamine                             | 0.01                                   | 0.00         | 0.00         | 0.01          | --           | 0.00         | 0.00         | 0.00          |
| Dimethylamine                               | 0.02                                   | 0.01         | 0.01         | 0.00          | --           | 0.00         | 0.03         | 0.15          |
| Trimethylamine                              | 0.00                                   | 0.00         | 0.00         | 0.00          | --           | 0.00         | 0.00         | 0.00          |
| Diethylamine                                | 0.00                                   | 0.00         | 0.00         | 0.00          | --           | 0.00         | 0.00         | 0.00          |
| Triethylamine                               | 0.00                                   | 0.00         | 0.00         | 0.00          | --           | 0.00         | 0.00         | 0.00          |



Table B-46. Car 24, FUEL NO. 1, 15,000 MILES

| Test Number,<br>Barometer,<br>Humidity,<br>Temperature,<br><br>Total Fuel Sulfur, mg/km<br>Carbon Dioxide, g/km<br>Fuel Cons., l/100 km<br><br>Regulated Emissions<br>Hydrocarbons (THC), g/km<br>Carbon Monoxide, g/km<br>Oxides of Nitrogen, g/km<br><br>Particulates<br>Sulfate<br>Sulfate as % of TFS, %<br><br>Compound Group Totals<br>Aldehydes & Ketones<br>Individual Hydrocarbons<br>Organic Sulfides<br>Organic Amines<br><br>Other Compounds<br>Ammonia<br>Cyanide & Cyanogen<br>DMNA<br><br>Hydrogen Sulfide<br>Nickel Carbonyl<br>Nitrous Oxide<br>Sulfur Dioxide | EMISSION RATE, MG/KM (Except as Noted) |        |        |        |        |        |        |      |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|--------|--------|--------|--------|--------|--------|------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | FTP                                    | SET    | HFET   | NYCC   | FTP    | SET    | HFET   | NYCC |
| 243111                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 243112                                 | 243113 | 243114 | 243121 | 243122 | 243123 | 243124 |      |
| 736.6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 736.9                                  | 736.9  | 736.9  | 742.2  | 743.2  | 743.2  | 743.2  |      |
| 11.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 11.2                                   | 12.8   | 10.7   | 9.3    | 8.1    | 9.9    | 8.3    |      |
| 22.8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 25.6                                   | 27.2   | 26.7   | 23.3   | 26.1   | 26.7   | 27.2   |      |
| 1.12                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.87                                   | 0.77   | 2.14   | 1.19   | 0.92   | 0.79   | 2.22   |      |
| 344.9                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 271.4                                  | 239.7  | 660.6  | 367.2  | 287.0  | 246.2  | 682.4  |      |
| 14.85                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 11.62                                  | 10.24  | 28.37  | 15.84  | 12.28  | 10.52  | 29.38  |      |
| 0.25                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.08                                   | 0.03   | 0.48   | 0.28   | 0.08   | 0.04   | 0.68   |      |
| 1.43                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.32                                   | 0.05   | 1.62   | 2.00   | 0.30   | 0.09   | 2.34   |      |
| 0.92                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1.43                                   | 1.61   | 1.26   | 1.20   | 1.68   | 1.55   | 1.22   |      |
| 0.06                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.18                                   | 0.56   | 0.06   | 0.01   | 0.10   | 0.27   | 0.01   |      |
| 1.79                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 6.90                                   | 24.24  | 0.93   | 0.28   | 3.62   | 11.39  | 0.15   |      |
| 3.9                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 5.5                                    | 4.7    | 27.6   | --     | --     | --     | --     |      |
| 113.4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 45.3                                   | 18.2   | 211.7  | 125.9  | 41.0   | 22.4   | 257.1  |      |
| 0.08                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.01                                   | 0.05   | 0.00   | 0.06   | 0.00   | 0.00   | 0.00   |      |
| 0.00                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.00                                   | 0.03   | 0.00   | 0.06   | 0.03   | 0.00   | 0.00   |      |
| 2.10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.90                                   | 0.27   | 6.87   | 1.51   | 0.70   | 1.87   | 4.38   |      |
| 1.56                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.33                                   | 0.66   | 1.69   | 1.63   | 0.17   | 0.08   | 10.38  |      |
| --                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | --                                     | --     | --     | --     | --     | --     | --     |      |
| 0.00                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |      |
| 0.00                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.00                                   | 0.00   | 0.00   | --     | --     | --     | --     |      |
| 35.69                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 21.71                                  | 13.70  | 67.19  | 40.07  | 30.46  | 19.33  | 111.80 |      |
| 7.21                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 7.84                                   | 4.43   | 28.52  | 7.81   | 6.88   | 7.30   | 31.35  |      |

Table B-46 (Cont'd). CAR 24, FUEL NO. 1, 15,000 MILES

|                         |        | EMISSION RATE, MG/KM (Except as Noted) |        |        |        |        |        |       |        |
|-------------------------|--------|----------------------------------------|--------|--------|--------|--------|--------|-------|--------|
|                         |        | FTP                                    |        | SET    |        | HFET   |        | NYCC  |        |
| Test Number,            | PVNFST | 243111                                 | 243112 | 243113 | 243114 | 243121 | 243122 | HFET  | NYCC   |
| Aldehydes and Ketones   |        |                                        |        |        |        |        |        |       |        |
| Formaldehyde            |        | 1.72                                   | 4.19   | 4.51   | 2.45   | --     | --     | --    | --     |
| Acetaldehyde            |        | 0.16                                   | 0.33   | 0.19   | 2.69   | --     | --     | --    | --     |
| Acetone                 |        | 0.60                                   | 0.00   | 0.00   | 2.99   | --     | --     | --    | --     |
| Isobutyraldehyde        |        | 2.03                                   | 0.96   | 0.00   | 19.45  | --     | --     | --    | --     |
| Methyl Ethyl Ketone     |        | 0.00                                   | 0.00   | 0.00   | 0.00   | --     | --     | --    | --     |
| Crotonaldehyde          |        | --                                     | --     | --     | --     | --     | --     | --    | --     |
| Hexanaldehyde           |        | 0.00                                   | 0.00   | 0.00   | 0.00   | --     | --     | --    | --     |
| Benzaldehyde            |        | --                                     | --     | --     | --     | --     | --     | --    | --     |
| Aldehydes and Ketones   |        | 3.9                                    | 5.5    | 4.7    | 27.6   | --     | --     | --    | --     |
| Total as % of THC,      |        | 1.6                                    | 6.9    | 15.7   | 5.8    | --     | --     | --    | --     |
| Individual Hydrocarbons |        |                                        |        |        |        |        |        |       |        |
| Methane                 |        | 71.51                                  | 37.01  | 15.59  | 164.55 | 62.45  | 30.30  | 17.61 | 142.34 |
| Ethylene                |        | 5.93                                   | 1.29   | 0.49   | 10.58  | 11.22  | 1.69   | 0.62  | 30.52  |
| Ethane                  |        | 10.55                                  | 4.61   | 1.82   | 24.71  | 8.59   | 3.68   | 2.06  | 24.23  |
| Acetylene               |        | 3.49                                   | 0.00   | 0.00   | 0.00   | 0.75   | 0.00   | 0.00  | 0.00   |
| Propane                 |        | 0.60                                   | 0.00   | 0.00   | 0.00   | 0.97   | 0.00   | 0.00  | 2.28   |
| Propylene               |        | 1.82                                   | 0.00   | 0.00   | 0.00   | 3.62   | 0.00   | 0.00  | 0.00   |
| Benzene                 |        | 11.95                                  | 2.39   | 0.26   | 11.84  | 28.15  | 5.29   | 2.06  | --     |
| Toluene                 |        | 7.50                                   | 0.00   | 0.00   | 0.00   | 10.15  | 0.00   | 0.00  | 2.30   |
| Total Individual HC     |        | 113.4                                  | 45.3   | 18.2   | 211.7  | 125.9  | 41.0   | 22.4  | 257.1  |
| Total as % of THC,      |        | 45.4                                   | 55.6   | 60.7   | 44.1   | 45.0   | 51.3   | 56.0  | 37.8   |
| Organic Sulfides        |        |                                        |        |        |        |        |        |       |        |
| Carbonyl Sulfide        |        | 0.05                                   | 0.00   | 0.05   | 0.00   | 0.02   | 0.00   | 0.00  | 0.00   |
| Methyl Sulfide          |        | 0.01                                   | 0.01   | 0.00   | 0.00   | 0.02   | 0.00   | 0.00  | 0.00   |
| Ethyl Sulfide           |        | 0.02                                   | 0.00   | 0.00   | 0.00   | 0.01   | 0.00   | 0.00  | 0.00   |
| Methyl Disulfide        |        | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.01   | 0.00   | 0.00  | 0.00   |
| Organic Amines          |        |                                        |        |        |        |        |        |       |        |
| Monomethylamine         |        | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00  | 0.00   |
| Monomethylamine         |        | 0.00                                   | 0.00   | 0.02   | 0.00   | 0.06   | 0.03   | 0.00  | 0.00   |
| Trimethylamine          |        | 0.00                                   | 0.00   | 0.01   | 0.00   | 0.00   | 0.00   | 0.00  | 0.00   |
| Diethylamine            |        | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00  | 0.00   |
| Triethylamine           |        | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00  | 0.00   |

Table B-47 . CAR 24, FUEL NO. 2, 15,000 MILES

|                              | EMISSION RATE, MG/KM (Except as Noted) |        |        |        |        |        |        |        |
|------------------------------|----------------------------------------|--------|--------|--------|--------|--------|--------|--------|
|                              | FTP                                    | SET    | HFET   | NYCC   | FTP    | SET    | HFET   | NYCC   |
| Test Number, PVMPST          | 243211                                 | 243212 | 243213 | 243214 | 243221 | 243222 | 243223 | 243224 |
| Barometer, mm Hg             | 745.0                                  | 745.5  | 745.5  | 745.5  | 744.5  | 745.0  | 745.0  | 745.0  |
| Humidity, g/kg               | 9.9                                    | 8.5    | 8.7    | 10.1   | 7.8    | 8.7    | 9.7    | 10.1   |
| Temperature, °C              | 23.3                                   | 25.0   | 26.1   | 26.1   | 22.2   | 24.4   | 23.9   | 26.1   |
| Total Fuel Sulfur, mg/km     | 36.12                                  | 27.17  | 23.16  | 65.05  | 35.21  | 27.07  | 21.37  | 65.63  |
| Carbon Dioxide, g/km         | 372.0                                  | 281.1  | 240.1  | 671.7  | 362.7  | 280.1  | 221.5  | 677.1  |
| Fuel Cons., l/100 km         | 15.99                                  | 12.03  | 10.25  | 28.80  | 15.59  | 11.99  | 9.46   | 29.05  |
| <b>Regulated Emissions</b>   |                                        |        |        |        |        |        |        |        |
| Hydrocarbons (THC), g/km     | 0.23                                   | 0.07   | 0.03   | 0.45   | 0.23   | 0.08   | 0.03   | 0.41   |
| Carbon Monoxide, g/km        | 1.18                                   | 0.30   | 0.05   | 1.09   | 1.10   | 0.26   | 0.05   | 1.47   |
| Oxides of Nitrogen, g/km     | 1.10                                   | 1.35   | 1.35   | 1.31   | 1.02   | 1.42   | 1.32   | 1.33   |
| <b>Particulates</b>          |                                        |        |        |        |        |        |        |        |
| Sulfate                      | 0.08                                   | 2.12   | 6.25   | 0.15   | 0.27   | 4.63   | 15.54  | 0.25   |
| Sulfate as % of TFS, %       | 0.07                                   | 2.60   | 9.00   | 0.08   | 0.26   | 5.70   | 24.24  | 0.13   |
| <b>Compound Group Totals</b> |                                        |        |        |        |        |        |        |        |
| Aldehydes & Ketones          | 9.6                                    | 7.9    | 6.3    | 78.2   | 7.6    | 3.5    | 5.4    | 51.4   |
| Individual Hydrocarbons      | 106.6                                  | 49.2   | 21.1   | 187.8  | 102.3  | 47.4   | 21.9   | 215.3  |
| Organic Sulfides             | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Organic Amines               | 0.04                                   | 0.00   | 0.00   | 0.00   | 0.04   | 0.02   | 0.02   | 0.19   |
| <b>Other Compounds</b>       |                                        |        |        |        |        |        |        |        |
| Ammonia                      | 2.68                                   | 1.30   | 1.81   | 17.93  | 2.88   | 0.71   | 1.02   | 8.08   |
| Cyanide & Cyanogen           | 0.97                                   | 0.17   | 0.72   | 2.43   | 0.94   | 0.53   | 0.14   | 2.45   |
| DMNA                         | --                                     | --     | --     | --     | --     | --     | --     | --     |
| Hydrogen Sulfide             | 0.00                                   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Nickel Carbonyl              | 0.00                                   | 0.00   | 0.00   | 0.00   | --     | --     | --     | --     |
| Nitrous Oxide                | 34.95                                  | 27.16  | 16.58  | 77.23  | 37.35  | 25.62  | 13.93  | 78.11  |
| Sulfur Dioxide               | 27.48                                  | 44.36  | 19.55  | 62.37  | 30.86  | 47.35  | 18.84  | 95.29  |

Table B-47 (Cont'd). CAR 24, FUEL NO. 2, 15,000 MILES

| EMISSION RATE, MG/KM (Except as Noted) |        |        |        |        |        |        |
|----------------------------------------|--------|--------|--------|--------|--------|--------|
| Test Number,<br>Aldehydes and Ketones  | PMWFST |        | NYCC   |        | NYCC   |        |
|                                        | FTP    | SET    | HFET   | FTP    | SET    | HFET   |
| Formaldehyde                           | 243211 | 243212 | 243213 | 243214 | 243221 | 243222 |
| Acetaldehyde                           | 4.18   | 5.88   | 5.89   | 0.66   | 2.65   | 3.15   |
| Acetone                                | 3.00   | 0.60   | 0.44   | 4.46   | 0.00   | 0.00   |
| Isobutyraldehyde                       | 0.27   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Methyl Ethyl Ketone                    | 2.17   | 1.39   | 0.00   | 73.06  | 4.99   | 0.00   |
| Crotonaldehyde                         | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Hexanaldehyde                          | --     | --     | --     | --     | --     | --     |
| Benzaldehyde                           | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Aldehydes and Ketones                  | 9.6    | 7.9    | 6.3    | 78.2   | 7.6    | 3.5    |
| Total as % of THC,                     | 4.2    | 11.3   | 21.0   | 17.4   | 3.3    | 4.4    |
| Individual Hydrocarbons                |        |        |        |        |        |        |
| Methane                                | 67.00  | 38.47  | 18.16  | 144.69 | 62.76  | 37.67  |
| Ethylene                               | 8.08   | 1.80   | 0.08   | 9.04   | 8.07   | 1.54   |
| Ethane                                 | 9.75   | 5.98   | 2.60   | 26.17  | 8.09   | 5.46   |
| Acetylene                              | 0.72   | 0.00   | 0.00   | 0.00   | 0.69   | 0.00   |
| Propane                                | 0.00   | 0.67   | 0.00   | 0.00   | 1.10   | 0.66   |
| Propylene                              | 1.72   | 0.00   | 0.00   | 0.00   | 1.85   | 0.00   |
| Benzene                                | 11.66  | 2.23   | 0.21   | 7.94   | 10.76  | 2.02   |
| Toluene                                | 7.67   | 0.00   | 0.00   | 0.00   | 8.99   | 0.00   |
| Total Individual HC                    | 106.6  | 49.2   | 21.1   | 187.8  | 102.3  | 47.4   |
| Total as % of THC,                     | 46.3   | 70.3   | 70.3   | 41.7   | 44.5   | 50.3   |
| Organic Sulfides                       |        |        |        |        |        |        |
| Carbonyl Sulfide                       | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Methyl Sulfide                         | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Ethyl Sulfide                          | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Methyl Disulfide                       | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Organic Amines                         |        |        |        |        |        |        |
| Monomethylamine                        | 0.00   | 0.00   | 0.00   | 0.00   | 0.03   | 0.01   |
| Dimethylamine                          | 0.04   | 0.00   | 0.00   | 0.00   | 0.01   | 0.01   |
| Trimethylamine                         | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.01   |
| Diethylamine                           | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |
| Triethylamine                          | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   | 0.00   |

Table B-48. CAR 24, FUEL NO. 3, 15,000 MILES

|                              | EMISSION RATE, MG/KM (Except as Noted) |        |        |        |        |        |        |        |
|------------------------------|----------------------------------------|--------|--------|--------|--------|--------|--------|--------|
|                              | FTP                                    | SET    | HFET   | NYCC   | FTP    | SET    | HFET   | NYCC   |
| Test Number, PUMPST          | 243311                                 | 243312 | 243313 | 243314 | 243321 | 243322 | 243323 | 243324 |
| Barometer, mm Hg             | 742.4                                  | 742.9  | 742.9  | 742.9  | 747.0  | 747.8  | 747.8  | 747.8  |
| Humidity, g/kg               | 11.3                                   | 12.1   | 12.1   | 12.4   | 4.7    | 7.4    | 5.9    | 4.5    |
| Temperature, °C              | 23.3                                   | 25.0   | 26.7   | 26.1   | 25.0   | 24.4   | 25.0   | 25.6   |
| Total Fuel Sulfur, mg/km     | 34.85                                  | 26.69  | 22.88  | 63.90  | 34.65  | 26.37  | 22.53  | 63.52  |
| Carbon Dioxide, g/km         | 357.9                                  | 275.3  | 236.1  | 659.4  | 355.8  | 272.4  | 232.8  | 655.0  |
| Fuel Cons., l/100 km         | 15.38                                  | 11.78  | 10.10  | 28.20  | 15.29  | 11.64  | 9.94   | 28.03  |
| <u>Regulated Emissions</u>   |                                        |        |        |        |        |        |        |        |
| Hydrocarbons (THC), g/km     | 0.20                                   | 0.07   | 0.04   | 0.30   | 0.20   | 0.06   | 0.03   | 0.28   |
| Carbon Monoxide, g/km        | 1.13                                   | 0.24   | 0.26   | 0.24   | 1.19   | 0.05   | 0.03   | 0.54   |
| Oxides of Nitrogen, g/km     | 0.91                                   | 1.09   | 0.72   | 1.04   | 0.94   | 1.35   | 1.22   | 1.12   |
| <u>Particulates</u>          |                                        |        |        |        |        |        |        |        |
| Sulfate as % of TFS, %       | 1.08                                   | 14.32  | 11.51  | 0.06   | 1.59   | 19.69  | 15.68  | 0.62   |
|                              | 1.03                                   | 17.88  | 16.77  | 0.03   | 1.53   | 24.89  | 23.20  | 0.33   |
| <u>Compound Group Totals</u> |                                        |        |        |        |        |        |        |        |
| Aldehydes & Ketones          | 6.4                                    | 2.6    | 5.2    | 37.6   | 13.2   | 4.3    | 4.6    | 21.2   |
| Individual Hydrocarbons      | 102.1                                  | 46.8   | 24.7   | 185.3  | 99.4   | 36.6   | 21.5   | 181.3  |
| Organic Sulfides             | 0.09                                   | 0.18   | 0.16   | 8.90   | 0.04   | 0.01   | 0.00   | 0.00   |
| Organic Amines               | 0.03                                   | 0.00   | 0.02   | 0.17   | 0.05   | 0.00   | 0.00   | 0.10   |
| <u>Other Compounds</u>       |                                        |        |        |        |        |        |        |        |
| Ammonia                      | 1.71                                   | 1.04   | 2.72   | 25.55  | 3.48   | 2.35   | 0.73   | 12.13  |
| Cyanide & Cyanogen           | 0.47                                   | 0.21   | 0.24   | 2.88   | 0.05   | 0.00   | 0.03   | 0.00   |
| DMRA                         | --                                     | --     | --     | --     | --     | --     | --     | --     |
| Hydrogen Sulfide             | 0.00                                   | 0.00   | 0.09   | 0.00   | --     | --     | --     | --     |
| Nickel Carbonyl              | 0.00                                   | 0.00   | 0.00   | 0.00   | --     | --     | --     | --     |
| Nitrous Oxide                | --                                     | --     | --     | 45.94  | 36.13  | 14.64  | 9.23   | 78.70  |
| Sulfur Dioxide               | 21.20                                  | 29.87  | 26.59  | 23.67  | 20.05  | 27.31  | 8.72   | 48.76  |

Table B-4B (Cont'd). CAR 24, FUEL NO. 3, 15,000 MILES

| EMISSION RATE, MG/KM (Except as Noted)              |            |            |             |        |              |             |            |             |             |
|-----------------------------------------------------|------------|------------|-------------|--------|--------------|-------------|------------|-------------|-------------|
| Test Number,<br>Fuel System                         | FTP        | SET        | HFET        | NYCC   |              | FTP         | SET        | HFET        | NYCC        |
|                                                     |            |            |             | 243312 | 243313       |             | 243321     | 243322      | 243324      |
| <b>Aldehydes and Ketones</b>                        |            |            |             |        |              |             |            |             |             |
| Formaldehyde                                        | 4.27       | 1.79       | 3.06        |        | 2.03         | 9.73        | 3.48       | 3.52        | 8.91        |
| Acetaldehyde                                        | 0.59       | 0.43       | 0.39        |        | 3.36         | 1.36        | 0.41       | 0.55        | 2.41        |
| Acetone                                             | 0.00       | 0.00       | 0.00        |        | 0.00         | 0.00        | 0.00       | 0.00        | 0.00        |
| Isobutyraldehyde                                    | 0.98       | 0.14       | 1.15        |        | 24.96        | 1.02        | 0.18       | 0.19        | 6.06        |
| Methyl Ethyl Ketone                                 | 0.00       | 0.00       | 0.00        |        | 0.00         | 0.00        | 0.00       | 0.00        | 0.00        |
| Crotonaldehyde                                      | --         | --         | --          |        | --           | --          | --         | --          | --          |
| Hexanaldehyde                                       | 0.60       | 0.23       | 0.64        |        | 7.20         | 1.10        | 0.22       | 0.36        | 3.84        |
| Benzaldehyde                                        | --         | --         | --          |        | --           | --          | --         | --          | --          |
| <b>Aldehydes and Ketones<br/>Total as % of THC,</b> | 6.4<br>3.2 | 2.6<br>3.7 | 5.2<br>13.0 |        | 37.6<br>12.5 | 13.2<br>6.6 | 4.3<br>7.2 | 4.6<br>15.3 | 21.2<br>7.6 |
| <b>Individual Hydrocarbons</b>                      |            |            |             |        |              |             |            |             |             |
| Methane                                             | 77.69      | 40.05      | 20.44       |        | 154.44       | 75.10       | 31.09      | 18.69       | 154.63      |
| Ethylene                                            | 5.22       | 0.34       | 0.78        |        | 0.28         | 6.23        | 0.12       | 0.08        | 0.56        |
| Ethane                                              | 11.77      | 6.26       | 2.84        |        | 27.42        | 10.63       | 5.18       | 2.71        | 25.49       |
| Acetylene                                           | 1.56       | 0.00       | 0.00        |        | 0.00         | 1.76        | 0.00       | 0.00        | 0.00        |
| Propane                                             | 1.07       | 0.18       | 0.00        |        | 2.33         | 0.22        | 0.06       | 0.00        | 0.59        |
| Propylene                                           | 1.98       | 0.00       | 0.37        |        | 0.00         | 2.46        | 0.00       | 0.00        | 0.00        |
| Benzene                                             | 2.14       | 0.00       | 0.31        |        | 0.78         | 1.84        | 0.16       | 0.00        | 0.00        |
| Toluene                                             | 0.63       | 0.00       | 0.00        |        | 0.00         | 1.17        | 0.00       | 0.00        | 0.00        |
| <b>Total Individual HC</b>                          | 102.1      | 46.8       | 24.7        |        | 185.3        | 99.4        | 36.6       | 21.5        | 181.3       |
| <b>Total as % of THC,</b>                           | 51.1       | 66.9       | 61.8        |        | 61.8         | 49.7        | 61.0       | 71.7        | 64.8        |
| <b>Organic Sulfides</b>                             |            |            |             |        |              |             |            |             |             |
| Carbonyl Sulfide                                    | 0.00       | 0.09       | 0.15        |        | 7.35         | 0.03        | 0.00       | 0.00        | 0.00        |
| Methyl Sulfide                                      | 0.03       | 0.06       | 0.00        |        | 0.47         | 0.01        | 0.01       | 0.00        | 0.00        |
| Ethyl Sulfide                                       | 0.03       | 0.02       | 0.00        |        | 0.81         | 0.00        | 0.00       | 0.00        | 0.00        |
| Methyl Disulfide                                    | 0.03       | 0.01       | 0.01        |        | 0.27         | 0.00        | 0.00       | 0.00        | 0.00        |
| <b>Organic Amines</b>                               |            |            |             |        |              |             |            |             |             |
| Monomethylamine                                     | 0.01       | 0.00       | 0.00        |        | 0.05         | 0.02        | 0.00       | 0.00        | 0.00        |
| Dimethylamine                                       | 0.02       | 0.00       | 0.02        |        | 0.12         | 0.03        | 0.00       | 0.00        | 0.10        |
| Trimethylamine                                      | 0.00       | 0.00       | 0.00        |        | 0.00         | 0.00        | 0.00       | 0.00        | 0.00        |
| Diethylamine                                        | 0.00       | 0.00       | 0.00        |        | 0.00         | 0.00        | 0.00       | 0.00        | 0.00        |
| Triethylamine                                       | 0.00       | 0.00       | 0.00        |        | 0.00         | 0.00        | 0.00       | 0.00        | 0.00        |

APPENDIX C  
FTP INDIVIDUAL SAMPLE RESULTS



TABLE C-1. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test 210111 - Fuel No. 1, 0 Miles

|                                | Emissions in mg/km |          |          |      |
|--------------------------------|--------------------|----------|----------|------|
|                                | COLD-UDDS          | HOT-UDDS |          |      |
| Sulfates                       | 0.21               | 0.13     |          |      |
| Ammonia                        | 3.16               | 0.00     |          |      |
| Cyanides & Cyanogen            | 0.03               | 0.05     |          |      |
| Hydrogen Sulfide               | 0.00               | 0.00     |          |      |
| Sulfur Dioxide                 | ----               | ----     |          |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |          |      |
| Formaldehyde                   | 0.00               | 0.05     |          |      |
| Acetaldehyde                   | 0.00               | 0.00     |          |      |
| Acetone                        | 0.00               | 0.00     |          |      |
| Isobutyraldehyde               | 0.00               | 0.10     |          |      |
| Methyl ethyl ketone            | 0.34               | 0.00     |          |      |
| Crotonaldehyde                 | ----               | ----     |          |      |
| Hexanaldehyde                  | 0.00               | 0.00     |          |      |
| Benzaldehyde                   | ----               | ----     |          |      |
| <u>Organic Sulfides</u>        |                    |          |          |      |
| Carbonyl sulfide               | 0.00               | ----     |          |      |
| Methyl sulfide                 | 0.00               | ----     |          |      |
| Ethyl sulfide                  | 0.00               | ----     |          |      |
| Methyl disulfide               | 0.00               | ----     |          |      |
| <u>Organic Amines</u>          |                    |          |          |      |
| Monomethylamine                | 0.00               | 0.00     |          |      |
| Monoethylamine & dimethylamine | 0.00               | 0.00     |          |      |
| Trimethylamine                 | 0.01               | 0.00     |          |      |
| Diethylamine                   | 0.00               | 0.00     |          |      |
| Triethylamine                  | 0.00               | 0.00     |          |      |
|                                |                    |          |          |      |
|                                | Emissions in ppm   |          |          |      |
|                                | COLD-UDDS          |          | HOT-UDDS |      |
|                                | 1                  | 2        | 3        | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |          |      |
| Methane                        | 8.02               | 1.94     | 2.39     | 1.81 |
| Ethylene                       | 5.94               | 0.12     | 0.21     | 0.01 |
| Ethane                         | 0.92               | 0.18     | 0.52     | 0.15 |
| Acetylene                      | 2.69               | 0.00     | 0.00     | 0.00 |
| Propane                        | 0.32               | 0.03     | 0.10     | 0.03 |
| Propylene                      | 2.29               | 0.00     | 0.00     | 0.00 |
| Benzene                        | 5.79               | 0.03     | 0.40     | 0.00 |
| Toluene                        | 9.45               | 0.00     | 0.05     | 0.00 |
| <u>Other</u>                   |                    |          |          |      |
| Nitrous Oxide                  | 1.03               | 0.23     | 1.40     | 0.25 |
| Nickel Carbonyl                | 0.00               | 0.00     | 0.00     | 0.00 |

TABLE C-2. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test 210112 - Fuel No. 1, 0 Miles

|                                | Emissions in mg/km |          |      |      |
|--------------------------------|--------------------|----------|------|------|
|                                | COLD-UDDS          | HOT-UDDS |      |      |
| Sulfates                       | 0.32               | 0.13     |      |      |
| Ammonia                        | 2.72               | 0.41     |      |      |
| Cyanides & Cyanogen            | 0.20               | 0.00     |      |      |
| Hydrogen Sulfide               | ----               | ----     |      |      |
| Sulfur Dioxide                 |                    |          |      |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |      |      |
| Formaldehyde                   | 0.09               | 0.00     |      |      |
| Acetaldehyde                   | 0.00               | 0.00     |      |      |
| Acetone                        | 0.00               | 0.00     |      |      |
| Isobutyraldehyde               | 0.00               | 0.00     |      |      |
| Methyl ethyl ketone            | 0.13               | 0.00     |      |      |
| Crotonaldehyde                 | ----               | ----     |      |      |
| Hexanaldehyde                  | 0.00               | 0.00     |      |      |
| Benzaldehyde                   | ----               | ----     |      |      |
| <u>Organic Sulfides</u>        |                    |          |      |      |
| Carbonyl sulfide               | 0.10               | 0.00     |      |      |
| Methyl sulfide                 | 0.00               | 0.00     |      |      |
| Ethyl sulfide                  | 0.00               | 0.00     |      |      |
| Methyl disulfide               | 0.00               | 0.00     |      |      |
| <u>Organic Amines</u>          |                    |          |      |      |
| Monomethylamine                | 0.00               | 0.00     |      |      |
| Monoethylamine & dimethylamine | 0.00               | 0.00     |      |      |
| Trimethylamine                 | 0.00               | 0.00     |      |      |
| Diethylamine                   | 0.00               | 0.00     |      |      |
| Triethylamine                  | 0.00               | 0.00     |      |      |
|                                | Emissions in ppm   |          |      |      |
|                                | COLD-UDDS          | HOT-UDDS |      |      |
|                                | 1                  | 2        | 3    | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |      |      |
| Methane                        | 5.96               | 0.93     | 2.56 | 1.21 |
| Ethylene                       | 4.44               | 0.19     | 0.43 | 0.05 |
| Ethane                         | 0.80               | 0.16     | 0.69 | 0.16 |
| Acetylene                      | 1.86               | 0.05     | 0.01 | 0.00 |
| Propane                        | 0.08               | 0.03     | 0.00 | 0.00 |
| Propylene                      | 1.80               | 0.01     | 0.02 | 0.00 |
| Benzene                        | 4.86               | 0.00     | 0.46 | 0.00 |
| Toluene                        | 7.50               | 0.04     | 0.34 | 4.03 |
| <u>Other</u>                   |                    |          |      |      |
| Nitrous Oxide                  | 0.98               | 0.26     | 1.84 | 0.24 |
| Nickel Carbonyl                | 0.00               | 0.00     | 0.00 | 0.00 |

TABLE C-3. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test 210211 - Fuel No. 2, 0 Miles

|                                | Emissions in mg/km |          |          |      |
|--------------------------------|--------------------|----------|----------|------|
|                                | COLD-UDDS          | HOT-UDDS |          |      |
| Sulfates                       | 0.10               | 0.11     |          |      |
| Ammonia                        | 19.32              | 4.97     |          |      |
| Cyanides & Cyanogen            | 0.72               | 0.00     |          |      |
| Hydrogen Sulfide               | 0.00               | 0.00     |          |      |
| Sulfur Dioxide                 | ----               | ----     |          |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |          |      |
| Formaldehyde                   | 0.00               | 0.11     |          |      |
| Acetaldehyde                   | 0.00               | 0.00     |          |      |
| Acetone                        | 0.16               | 4.83     |          |      |
| Isobutyraldehyde               | 0.00               | 0.00     |          |      |
| Methyl ethyl ketone            | 0.32               | 0.00     |          |      |
| Crotonaldehyde                 | ----               | ----     |          |      |
| Hexanaldehyde                  | 0.00               | 0.00     |          |      |
| Benzaldehyde                   | ----               | ----     |          |      |
| <u>Organic Sulfides</u>        |                    |          |          |      |
| Carbonyl sulfide               | 0.00               | 0.00     |          |      |
| Methyl sulfide                 | 0.00               | 0.00     |          |      |
| Ethyl sulfide                  | 0.00               | 0.00     |          |      |
| Methyl disulfide               | 0.00               | 0.00     |          |      |
| <u>Organic Amines</u>          |                    |          |          |      |
| Monomethylamine                | 0.00               | 0.00     |          |      |
| Monoethylamine & dimethylamine | 0.00               | 0.00     |          |      |
| Trimethylamine                 | 0.00               | 0.00     |          |      |
| Diethylamine                   | 0.00               | 0.00     |          |      |
| Triethylamine                  | 0.00               | 0.00     |          |      |
| <br>                           |                    |          |          |      |
|                                | Emissions in ppm   |          |          |      |
|                                | COLD-UDDS          |          | HOT-UDDS |      |
|                                | 1                  | 2        | 3        | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |          |      |
| Methane                        | 8.51               | 2.05     | 2.93     | 2.07 |
| Ethylene                       | 5.25               | 0.00     | 0.19     | 0.00 |
| Ethane                         | 0.83               | 0.17     | 0.53     | 0.13 |
| Acetylene                      | 2.55               | 0.05     | 0.00     | 0.00 |
| Propane                        | 0.17               | 0.00     | 0.06     | 0.00 |
| Propylene                      | 2.00               | 0.00     | 0.05     | 0.00 |
| Benzene                        | 6.06               | 0.00     | 0.45     | 0.00 |
| Toluene                        | 9.27               | 0.00     | 0.00     | 0.00 |
| <br>                           |                    |          |          |      |
| <u>Other</u>                   |                    |          |          |      |
| Nitrous Oxide                  | 1.01               | 0.28     | 1.65     | 0.27 |
| Nickel Carbonyl                | 0.00               | 0.00     | 0.00     | 0.00 |

TABLE C-4. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test 210221 - Fuel No. 2, 0 Miles

|                                | Emissions in mg/km |          |
|--------------------------------|--------------------|----------|
|                                | COLD-UDDS          | HOT-UDDS |
| Sulfates                       | 0.16               | 0.64     |
| Ammonia                        | 1.27               | 0.29     |
| Cyanides & Cyanogen            | 0.75               | 0.00     |
| Hydrogen Sulfide               | 0.00               | 0.00     |
| Sulfur Dioxide                 | ----               | ----     |
| <u>Aldehydes &amp; Ketones</u> |                    |          |
| Formaldehyde                   | 0.34               | 0.30     |
| Acetaldehyde                   | 0.20               | 0.81     |
| Acetone                        | 0.00               | 0.00     |
| Isobutyraldehyde               | 0.00               | 0.00     |
| Methyl ethyl ketone            | 0.25               | 0.21     |
| Crotonaldehyde                 | ----               | ----     |
| Hexanaldehyde                  | 0.00               | 0.00     |
| Benzaldehyde                   | ----               | ----     |
| <u>Organic Sulfides</u>        |                    |          |
| Carbonyl sulfide               | 0.00               | 0.00     |
| Methyl sulfide                 | 0.00               | 0.00     |
| Ethyl sulfide                  | 0.00               | 0.00     |
| Methyl disulfide               | 0.00               | 0.00     |
| <u>Organic Amines</u>          |                    |          |
| Monomethylamine                | 0.01               | 0.03     |
| Monoethylamine & dimethylamine | 0.00               | 0.01     |
| Trimethylamine                 | 0.00               | 0.00     |
| Diethylamine                   | 0.00               | 0.00     |
| Triethylamine                  | 0.00               | 0.00     |

|                                | Emissions in ppm |      |          |      |
|--------------------------------|------------------|------|----------|------|
|                                | COLD-UDDS        |      | HOT-UDDS |      |
|                                | 1                | 2    | 3        | 4    |
| <u>Individual Hydrocarbons</u> |                  |      |          |      |
| Methane                        | 6.61             | 2.00 | 2.60     | 1.98 |
| Ethylene                       | 4.95             | 0.03 | 0.17     | 0.06 |
| Ethane                         | 0.87             | 0.20 | 0.47     | 0.19 |
| Acetylene                      | 2.20             | 0.05 | 0.05     | 0.05 |
| Propane                        | 0.17             | 0.00 | 0.09     | 0.00 |
| Propylene                      | 2.19             | 0.00 | 0.02     | 0.00 |
| Benzene                        | 6.00             | 0.00 | 0.00     | 0.00 |
| Toluene                        | 9.26             | 0.00 | 0.00     | 0.00 |
| <u>Other</u>                   |                  |      |          |      |
| Nitrous Oxide                  | 1.32             | 0.35 | 1.59     | 0.31 |
| Nickel Carbonyl                | 0.00             | 0.00 | 0.00     | 0.00 |

TABLE C-5. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test 210311 Run 2 - Fuel No. 3, 0 Miles

|                                | Emissions in mg/km |          |          |      |
|--------------------------------|--------------------|----------|----------|------|
|                                | COLD-UDDS          | HOT-UDDS |          |      |
| Sulfates                       | 0.26               | 1.83     |          |      |
| Ammonia                        | 2.83               | 1.62     |          |      |
| Cyanides & Cyanogen            | ----               | 0.00     |          |      |
| Hydrogen Sulfide               | 0.00               | 0.00     |          |      |
| Sulfur Dioxide                 | ----               | ----     |          |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |          |      |
| Formaldehyde                   | 0.21               | 0.16     |          |      |
| Acetaldehyde                   | 0.00               | 0.00     |          |      |
| Acetone                        | 0.00               | 0.03     |          |      |
| Isobutyraldehyde               | 0.00               | 0.00     |          |      |
| Methyl ethyl ketone            | 0.00               | 0.19     |          |      |
| Crotonaldehyde                 | ----               | ----     |          |      |
| Hexanaldehyde                  | 0.00               | 0.00     |          |      |
| Benzaldehyde                   | ----               | ----     |          |      |
| <u>Organic Sulfides</u>        |                    |          |          |      |
| Carbonyl sulfide               | 0.08               | 0.05     |          |      |
| Methyl sulfide                 | 0.03               | 0.01     |          |      |
| Ethyl sulfide                  | 0.03               | 0.00     |          |      |
| Methyl disulfide               | 0.00               | 0.00     |          |      |
| <u>Organic Amines</u>          |                    |          |          |      |
| Monomethylamine                | 0.00               | 0.00     |          |      |
| Monoethylamine & dimethylamine | 0.01               | 0.00     |          |      |
| Trimethylamine                 | 0.00               | 0.00     |          |      |
| Diethylamine                   | 0.00               | 0.00     |          |      |
| Triethylamine                  | 0.00               | 0.00     |          |      |
| Emissions in ppm               |                    |          |          |      |
|                                | COLD-UDDS          |          | HOT-UDDS |      |
|                                | 1                  | 2        | 3        | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |          |      |
| Methane                        | 7.34               | 2.37     | 4.44     | 3.77 |
| Ethylene                       | 4.60               | 0.11     | 0.88     | 0.00 |
| Ethane                         | 0.69               | 0.20     | 0.88     | 0.30 |
| Acetylene                      | 1.97               | 0.12     | 0.00     | 0.00 |
| Propane                        | 0.28               | 0.00     | 0.26     | 0.05 |
| Propylene                      | 2.18               | 0.00     | 0.21     | 0.00 |
| Benzene                        | 1.96               | 0.15     | 0.15     | 0.03 |
| Toluene                        | 1.41               | 0.00     | 0.00     | 0.00 |
| <u>Other</u>                   |                    |          |          |      |
| Nitrous Oxide                  | 0.76               | 0.19     | 1.07     | 0.20 |
| Nickel Carbonyl                | 0.00               | 0.00     | 0.00     | 0.00 |

TABLE C-6. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test 210321 Run 2 - Fuel No. 3, 0 Miles

|                                | Emissions in mg/km |          |
|--------------------------------|--------------------|----------|
|                                | COLD-UDDS          | HOT-UDDS |
| Sulfates                       | 0.22               | 1.71     |
| Ammonia                        | 1.71               | 1.96     |
| Cyanides & Cyanogen            | 0.18               | 0.00     |
| Hydrogen Sulfide               | 0.00               | 0.00     |
| Sulfur Dioxide                 | ----               | ----     |
| <u>Aldehydes &amp; Ketones</u> |                    |          |
| Formaldehyde                   | 0.25               | 0.20     |
| Acetaldehyde                   | 0.00               | 0.00     |
| Acetone                        | 0.00               | 0.00     |
| Isobutyraldehyde               | 0.00               | 0.00     |
| Methyl ethyl ketone            | 0.00               | 0.00     |
| Crotonaldehyde                 | ----               | ----     |
| Hexanaldehyde                  | 0.00               | 0.00     |
| Benzaldehyde                   | ----               | ----     |
| <u>Organic Sulfides</u>        |                    |          |
| Carbonyl sulfide               | 0.03               | ----     |
| Methyl sulfide                 | 0.00               | ----     |
| Ethyl sulfide                  | 0.00               | ----     |
| Methyl disulfide               | 0.01               | ----     |
| <u>Organic Amines</u>          |                    |          |
| Monomethylamine                | 0.00               | 0.00     |
| Monoethylamine & dimethylamine | 0.00               | 0.00     |
| Trimethylamine                 | 0.00               | 0.00     |
| Diethylamine                   | 0.00               | 0.00     |
| Triethylamine                  | 0.00               | 0.00     |

|                                | Emissions in ppm |      |          |      |
|--------------------------------|------------------|------|----------|------|
|                                | COLD-UDDS        |      | HOT-UDDS |      |
|                                | 1                | 2    | 3        | 4    |
| <u>Individual Hydrocarbons</u> |                  |      |          |      |
| Methane                        | 8.35             | 2.34 | 4.61     | 3.72 |
| Ethylene                       | 5.76             | 0.17 | 1.05     | 0.02 |
| Ethane                         | 1.02             | 0.24 | 0.99     | 0.31 |
| Acetylene                      | 2.61             | 0.02 | 0.00     | 0.00 |
| Propane                        | 0.08             | 0.00 | 0.06     | 0.02 |
| Propylene                      | 2.68             | 0.00 | 0.19     | 0.00 |
| Benzene                        | 2.16             | 0.00 | 0.17     | 0.08 |
| Toluene                        | 1.59             | 0.00 | 0.00     | 0.00 |
| <u>Other</u>                   |                  |      |          |      |
| Nitrous Oxide                  | 0.91             | 0.29 | 1.28     | 0.30 |
| Nickel Carbonyl                | 0.00             | 0.00 | 0.00     | 0.00 |

TABLE C-7. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test 211111 - Fuel #1, 5000 Miles

|                                | Emissions in mg/km |          |
|--------------------------------|--------------------|----------|
|                                | COLD-UDDS          | HOT-UDDS |
| Sulfates                       | 0.21               | 0.12     |
| Ammonia                        | 4.85               | 7.07     |
| Cyanides & Cyanogen            | 1.85               | 0.57     |
| Hydrogen Sulfide               | 0.00               | 0.00     |
| Sulfur Dioxide                 | ----               | ----     |
| <u>Aldehydes &amp; Ketones</u> |                    |          |
| Formaldehyde                   | 0.94               | 0.78     |
| Acetaldehyde                   | 0.07               | 0.14     |
| Acetone                        | 0.56               | 0.64     |
| Isobutyraldehyde               | 0.00               | 0.00     |
| Methyl ethyl ketone            | 0.00               | 0.00     |
| Crotonaldehyde                 | ----               | ----     |
| Hexanaldehyde                  | 0.00               | 0.00     |
| Benzaldehyde                   | ----               | ----     |
| <u>Organic Sulfides</u>        |                    |          |
| Carbonyl sulfide               | ----               | ----     |
| Methyl sulfide                 | ----               | ----     |
| Ethyl sulfide                  | ----               | ----     |
| Methyl disulfide               | ----               | ----     |
| <u>Organic Amines</u>          |                    |          |
| Monomethylamine                | 0.00               | 0.00     |
| Monoethylamine & dimethylamine | 0.00               | 0.00     |
| Trimethylamine                 | 0.00               | 0.00     |
| Diethylamine                   | 0.00               | 0.00     |
| Triethylamine                  | 0.00               | 0.00     |

|                                | Emissions in ppm |      |          |      |
|--------------------------------|------------------|------|----------|------|
|                                | COLD-UDDS        |      | HOT-UDDS |      |
|                                | 1                | 2    | 3        | 4    |
| <u>Individual Hydrocarbons</u> |                  |      |          |      |
| Methane                        | 7.67             | 2.20 | 3.25     | 3.14 |
| Ethylene                       | 5.10             | 0.12 | 0.51     | 0.12 |
| Ethane                         | 0.91             | 0.32 | 0.70     | 0.36 |
| Acetylene                      | 2.56             | 0.00 | 0.00     | 0.00 |
| Propane                        | 0.00             | 0.45 | 0.47     | 0.18 |
| Propylene                      | 1.98             | 0.00 | 0.02     | 0.00 |
| Benzene                        | 5.57             | 0.10 | 0.91     | 0.05 |
| Toluene                        | 3.49             | 0.00 | 0.12     | 0.00 |
| <u>Other</u>                   |                  |      |          |      |
| Nitrous Oxide                  | 0.98             | 0.25 | 1.49     | 0.21 |
| Nickel Carbonyl                | 0.00             | 0.00 | 0.00     | 0.00 |

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TABLE C-8 FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test 211121 - Fuel #1, 5000 Miles

|                                | Emissions in mg/km |          |
|--------------------------------|--------------------|----------|
|                                | COLD-UDDS          | HOT-UDDS |
| Sulfates                       | 0.23               | 0.04     |
| Ammonia                        | 3.61               | 5.48     |
| Cyanides & Cyanogen            | 2.60               | 0.68     |
| Hydrogen Sulfide               | 0.00               | 0.00     |
| Sulfur Dioxide                 | ----               | ----     |
| <u>Aldehydes &amp; Ketones</u> |                    |          |
| Formaldehyde                   | 0.74               | 0.84     |
| Acetaldehyde                   | 0.00               | 0.00     |
| Acetone                        | 0.00               | 0.00     |
| Isobutyraldehyde               | 0.29               | 3.43     |
| Methyl ethyl ketone            | 0.00               | 0.00     |
| Crotonaldehyde                 | ----               | ----     |
| Hexanaldehyde                  | 0.00               | 0.00     |
| Benzaldehyde                   | ----               | ----     |
| <u>Organic Sulfides</u>        |                    |          |
| Carbonyl sulfide               | 0.07               | 0.09     |
| Methyl sulfide                 | 0.02               | 0.00     |
| Ethyl sulfide                  | 0.05               | 0.00     |
| Methyl disulfide               | 0.02               | 0.00     |
| <u>Organic Amines</u>          |                    |          |
| Monomethylamine                | 0.00               | 0.00     |
| Monoethylamine & dimethylamine | 0.00               | 0.02     |
| Trimethylamine                 | 0.00               | 0.01     |
| Diethylamine                   | 0.00               | 0.00     |
| Triethylamine                  | 0.00               | 0.00     |

|                                | Emissions in ppm |      |          |      |
|--------------------------------|------------------|------|----------|------|
|                                | COLD-UDDS        |      | HOT-UDDS |      |
|                                | 1                | 2    | 3        | 4    |
| <u>Individual Hydrocarbons</u> |                  |      |          |      |
| Methane                        | 9.38             | 3.07 | 3.72     | 3.82 |
| Ethylene                       | 5.80             | 0.12 | 0.91     | 0.06 |
| Ethane                         | 1.01             | 0.36 | 0.86     | 0.40 |
| Acetylene                      | 3.01             | 0.00 | 0.00     | 0.00 |
| Propane                        | 0.43             | 0.16 | 0.27     | 0.09 |
| Propylene                      | 2.23             | 0.00 | 0.19     | 0.02 |
| Benzene                        | 6.31             | 0.05 | 1.01     | 0.05 |
| Toluene                        | 9.30             | 0.02 | 0.40     | 0.00 |
| <u>Other</u>                   |                  |      |          |      |
| Nitrous Oxide                  | 1.01             | 0.27 | 1.25     | 0.24 |
| Nickel Carbonyl                | ----             | ---- | ----     | ---- |

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TABLE C-9. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test 211211 - Fuel #2, 5000 Miles

|                                | Emissions in mg/km |          |      |      |
|--------------------------------|--------------------|----------|------|------|
|                                | COLD-UDDS          | HOT-UDDS |      |      |
| Sulfates                       | 0.84               | 0.67     |      |      |
| Ammonia                        | 2.01               | 0.22     |      |      |
| Cyanides & Cyanogen            | 0.00               | 0.00     |      |      |
| Hydrogen Sulfide               | 0.00               | 0.00     |      |      |
| Sulfur Dioxide                 | ----               | ----     |      |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |      |      |
| Formaldehyde                   | 1.42               | 0.43     |      |      |
| Acetaldehyde                   | 0.02               | 0.00     |      |      |
| Acetone                        | 0.00               | 0.00     |      |      |
| Isobutyraldehyde               | 0.10               | 0.10     |      |      |
| Methyl ethyl ketone            | 0.00               | 0.00     |      |      |
| Crotonaldehyde                 | ----               | ----     |      |      |
| Hexanaldehyde                  | 0.00               | 0.00     |      |      |
| Benzaldehyde                   | ----               | ----     |      |      |
| <u>Organic Sulfides</u>        |                    |          |      |      |
| Carbonyl sulfide               | 0.56               | 0.26     |      |      |
| Methyl sulfide                 | 0.19               | 0.08     |      |      |
| Ethyl sulfide                  | 0.02               | 0.00     |      |      |
| Methyl disulfide               | 0.00               | 0.00     |      |      |
| <u>Organic Amines</u>          |                    |          |      |      |
| Monomethylamine                | 0.01               | 0.00     |      |      |
| Monoethylamine & dimethylamine | 0.01               | 0.00     |      |      |
| Trimethylamine                 | 0.01               | 0.00     |      |      |
| Diethylamine                   | 0.00               | 0.00     |      |      |
| Triethylamine                  | 0.00               | 0.00     |      |      |
|                                | Emissions in ppm   |          |      |      |
|                                | COLD-UDDS          | HOT-UDDS |      |      |
|                                | 1                  | 2        | 3    | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |      |      |
| Methane                        | 9.42               | 3.23     | 3.40 | 2.77 |
| Ethylene                       | 4.79               | 0.09     | 0.79 | 0.02 |
| Ethane                         | 0.83               | 0.40     | 0.84 | 0.34 |
| Acetylene                      | 2.87               | 0.00     | 0.00 | 0.00 |
| Propane                        | 0.14               | 0.08     | 0.13 | 0.04 |
| Propylene                      | 1.87               | 0.00     | 0.16 | 0.00 |
| Benzene                        | 5.96               | 0.41     | 1.14 | 0.03 |
| Toluene                        | 10.22              | 0.10     | 0.78 | 0.00 |
| <u>Other</u>                   |                    |          |      |      |
| Nitrous Oxide                  | 0.58               | 0.32     | 1.97 | 0.22 |
| Nickel Carbonyl                | 0.00               | 0.00     | 0.00 | 0.00 |

TABLE C-10. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test 211221 - Fuel #2, 5000 Miles

|                                | Emissions in mg/km |          |
|--------------------------------|--------------------|----------|
|                                | COLD-UDDS          | HOT-UDDS |
| <u>Sulfates</u>                | 1.84               | 0.96     |
| Ammonia                        | 3.56               | 1.72     |
| Cyanides & Cyanogen            | 0.95               | 0.30     |
| Hydrogen Sulfide               | 0.00               | 0.00     |
| Sulfur Dioxide                 | ----               | ----     |
| <u>Aldehydes &amp; Ketones</u> |                    |          |
| Formaldehyde                   | 1.92               | 0.31     |
| Acetaldehyde                   | 1.06               | 0.06     |
| Acetone                        | 0.00               | 0.00     |
| Isobutyraldehyde               | 0.63               | 0.95     |
| Methyl ethyl ketone            | 0.00               | 0.00     |
| Crotonaldehyde                 | ----               | ----     |
| Hexanaldehyde                  | 0.00               | 0.00     |
| Benzaldehyde                   | ----               | ----     |
| <u>Organic Sulfides</u>        |                    |          |
| Carbonyl sulfide               | 0.03               | 0.02     |
| Methyl sulfide                 | 0.02               | 0.00     |
| Ethyl sulfide                  | 0.33               | 0.00     |
| Methyl disulfide               | 0.09               | 0.00     |
| <u>Organic Amines</u>          |                    |          |
| Monomethylamine                | 0.02               | 0.01     |
| Monoethylamine & dimethylamine | 0.00               | 0.00     |
| Trimethylamine                 | 0.00               | 0.00     |
| Diethylamine                   | 0.00               | 0.00     |
| Triethylamine                  | 0.00               | 0.00     |

|                                | Emissions in ppm |      |          |      |
|--------------------------------|------------------|------|----------|------|
|                                | COLD-UDDS        |      | HOT-UDDS |      |
|                                | 1                | 2    | 3        | 4    |
| <u>Individual Hydrocarbons</u> |                  |      |          |      |
| Methane                        | 9.82             | 2.70 | 3.20     | 2.68 |
| Ethylene                       | 6.21             | 0.00 | 0.95     | 0.00 |
| Ethane                         | 0.97             | 0.28 | 0.69     | 0.16 |
| Acetylene                      | 3.50             | 0.00 | 0.00     | 0.00 |
| Propane                        | 0.06             | 0.00 | 0.05     | 0.00 |
| Propylene                      | 2.34             | 0.00 | 0.34     | 0.00 |
| Benzene                        | 6.92             | 0.00 | 1.40     | 0.00 |
| Toluene                        | 11.44            | 0.00 | 1.11     | 0.00 |
| <u>Other</u>                   |                  |      |          |      |
| Nitrous Oxide                  | 0.74             | 0.29 | 1.86     | 0.21 |
| Nickel Carbonyl                | 0.00             | 0.00 | 0.00     | 0.00 |

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TABLE C-12. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test 211321 - Fuel #3, 5000 Miles

|                                | Emissions in mg/km |          |      |      |
|--------------------------------|--------------------|----------|------|------|
|                                | COLD-UDDS          | HOT-UDDS |      |      |
| Sulfates                       | 2.38               | 1.42     |      |      |
| Ammonia                        | --                 | 2.92     |      |      |
| Cyanides & Cyanogen            | 0.00               | 0.18     |      |      |
| Hydrogen Sulfide               | 0.00               | 0.00     |      |      |
| Sulfur Dioxide                 | ----               | ----     |      |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |      |      |
| Formaldehyde                   | 2.75               | 1.83     |      |      |
| Acetaldehyde                   | 0.11               | 0.21     |      |      |
| Acetone                        | 0.00               | 0.09     |      |      |
| Isobutyraldehyde               | 2.22               | 0.12     |      |      |
| Methyl ethyl ketone            | 0.00               | 0.00     |      |      |
| Crotonaldehyde                 | ----               | ----     |      |      |
| Hexanaldehyde                  | 0.00               | 0.00     |      |      |
| Benzaldehyde                   | ----               | ----     |      |      |
| <u>Organic Sulfides</u>        |                    |          |      |      |
| Carbonyl sulfide               | 0.03               | 0.02     |      |      |
| Methyl sulfide                 | 0.00               | 0.01     |      |      |
| Ethyl sulfide                  | 0.05               | 0.00     |      |      |
| Methyl disulfide               | 0.00               | 0.00     |      |      |
| <u>Organic Amines</u>          |                    |          |      |      |
| Monomethylamine                | 0.00               | 0.00     |      |      |
| Monoethylamine & dimethylamine | 0.00               | 0.00     |      |      |
| Trimethylamine                 | 0.00               | 0.00     |      |      |
| Diethylamine                   | 0.00               | 0.00     |      |      |
| Triethylamine                  | 0.00               | 0.00     |      |      |
|                                | Emissions in ppm   |          |      |      |
|                                | COLD-UDDS          | HOT-UDDS |      |      |
|                                | 1                  | 2        | 3    | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |      |      |
| Methane                        | 10.03              | 5.63     | 8.44 | 9.11 |
| Ethylene                       | 5.81               | 0.03     | 3.44 | 0.50 |
| Ethane                         | 1.22               | 0.62     | 1.75 | 0.90 |
| Acetylene                      | 2.86               | 0.00     | 0.00 | 0.00 |
| Propane                        | 0.30               | 0.14     | 0.37 | 0.25 |
| Propylene                      | 2.44               | 0.00     | 0.73 | 0.06 |
| Benzene                        | 2.14               | 0.09     | 0.57 | 0.36 |
| Toluene                        | 2.17               | 0.03     | 0.18 | 0.12 |
| <u>Other</u>                   |                    |          |      |      |
| Nitrous Oxide                  | 0.79               | 0.29     | 1.22 | 0.26 |
| Nickel Carbonyl                | 0.00               | 0.00     | 0.00 | 0.00 |

TABLE C-13. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test No. 212111 - Fuel No. 1, 10,000 Miles

|                                | Emissions in mg/km |          |          |      |
|--------------------------------|--------------------|----------|----------|------|
|                                | COLD-UDDS          | HOT-UDDS |          |      |
| Sulfates                       | 0.52               | 1.73     |          |      |
| Ammonia                        | 1.43               | 4.39     |          |      |
| Cyanides & Cyanogen            | 1.45               | 0.81     |          |      |
| Hydrogen Sulfide               | 0.00               | 0.00     |          |      |
| Sulfur Dioxide                 | ----               | ----     |          |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |          |      |
| Formaldehyde                   | 0.45               | 0.77     |          |      |
| Acetaldehyde                   | 0.03               | 0.00     |          |      |
| Acetone                        | 0.00               | 0.00     |          |      |
| Isobutyraldehyde               | 0.06               | 0.82     |          |      |
| Methyl ethyl ketone            | 0.00               | 0.00     |          |      |
| Crotonaldehyde                 | --                 | --       |          |      |
| Hexanaldehyde                  | 0.00               | 0.00     |          |      |
| Benzaldehyde                   | --                 | --       |          |      |
| <u>Organic Sulfides</u>        |                    |          |          |      |
| Carbonyl sulfide               | 0.72               | 0.17     |          |      |
| Methyl sulfide                 | 0.05               | 0.07     |          |      |
| Ethyl sulfide                  | 0.01               | 0.00     |          |      |
| Methyl disulfide               | 0.01               | 0.01     |          |      |
| <u>Organic Amines</u>          |                    |          |          |      |
| Monomethylamine                | 0.00               | 0.00     |          |      |
| Monoethylamine & dimethylamine | 0.00               | 0.02     |          |      |
| Trimethylamine                 | 0.00               | 0.00     |          |      |
| Diethylamine                   | 0.00               | 0.00     |          |      |
| Triethylamine                  | 0.00               | 0.00     |          |      |
| Emissions in ppm               |                    |          |          |      |
|                                | COLD-UDDS          |          | HOT-UDDS |      |
|                                | 1                  | 2        | 3        | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |          |      |
| Methane                        | 9.25               | 3.20     | 3.48     | 2.53 |
| Ethylene                       | 5.06               | 0.00     | 0.74     | 0.01 |
| Ethane                         | 1.14               | 0.00     | 0.79     | 0.44 |
| Acetylene                      | 2.97               | 0.00     | 0.00     | 0.00 |
| Propane                        | 0.11               | 0.00     | 0.02     | 0.00 |
| Propylene                      | 2.02               | 0.00     | 0.10     | 0.00 |
| Benzene                        | 6.45               | 0.01     | 1.35     | 0.18 |
| Toluene                        | 10.38              | 0.00     | 0.79     | 0.00 |
| <u>Other</u>                   |                    |          |          |      |
| Nitrous Oxide                  | 0.71               | 0.59     | 1.17     | 0.49 |
| Nickel Carbonyl                | --                 | --       | --       | --   |

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TABLE C-14. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test No. 212121 - Fuel No. 1, 10,000 Miles

|                                | Emissions in mg/km |          |
|--------------------------------|--------------------|----------|
|                                | COLD-UDDS          | HOT-UDDS |
| Sulfates                       | 0.82               | 0.46     |
| Ammonia                        | 1.63               | 0.62     |
| Cyanides & Cyanogen            | 3.79               | 1.75     |
| Hydrogen Sulfide               | 0.00               | 0.00     |
| Sulfur Dioxide                 | ----               | ----     |
| <u>Aldehydes &amp; Ketones</u> |                    |          |
| Formaldehyde                   | 0.98               | 0.67     |
| Acetaldehyde                   | 0.00               | 0.00     |
| Acetone                        | 0.00               | 0.00     |
| Isobutyraldehyde               | 2.16               | 0.14     |
| Methyl ethyl ketone            | 0.00               | 0.00     |
| Crotonaldehyde                 | --                 | --       |
| Hexanaldehyde                  | 0.00               | 0.00     |
| Benzaldehyde                   | --                 | --       |
| <u>Organic Sulfides</u>        |                    |          |
| Carbonyl sulfide               | 0.06               | 0.00     |
| Methyl sulfide                 | 0.01               | 0.00     |
| Ethyl sulfide                  | 0.09               | 0.00     |
| Methyl disulfide               | 0.02               | 0.00     |
| <u>Organic Amines</u>          |                    |          |
| Monomethylamine                | 0.01               | 0.01     |
| Monoethylamine & dimethylamine | 0.00               | 0.01     |
| Trimethylamine                 | 0.00               | 0.00     |
| Diethylamine                   | 0.00               | 0.00     |
| Triethylamine                  | 0.00               | 0.00     |

|                                | Emissions in ppm |      |          |      |
|--------------------------------|------------------|------|----------|------|
|                                | COLD-UDDS        |      | HOT-UDDS |      |
|                                | 1                | 2    | 3        | 4    |
| <u>Individual Hydrocarbons</u> |                  |      |          |      |
| Methane                        | 10.84            | 3.22 | 3.79     | 2.85 |
| Ethylene                       | 6.12             | 0.14 | 1.94     | 0.10 |
| Ethane                         | 1.32             | 0.63 | 0.96     | 0.56 |
| Acetylene                      | 4.08             | 0.00 | 0.00     | 0.00 |
| Propane                        | 0.13             | 0.00 | 0.02     | 0.00 |
| Propylene                      | 2.42             | 0.00 | 0.90     | 0.00 |
| Benzene                        | 7.47             | 0.26 | 2.84     | 0.20 |
| Toluene                        | 12.16            | 0.02 | 2.52     | 0.02 |
| <u>Other</u>                   |                  |      |          |      |
| Nitrous Oxide                  | 0.46             | 0.40 | 1.77     | 0.44 |
| Nickel Carbonyl                | 0.00             | 0.00 | 0.00     | 0.00 |

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TABLE C-15. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test No. 212211 - Fuel No. 2, 10,000 Miles

|                                | Emissions in mg/km |          |      |      |
|--------------------------------|--------------------|----------|------|------|
|                                | COLD-UDDS          | HOT-UDDS |      |      |
| Sulfates                       | 0.21               | 0.31     |      |      |
| Ammonia                        | 1.96               | 2.55     |      |      |
| Cyanides & Cyanogen            | 0.17               | 0.74     |      |      |
| Hydrogen Sulfide               | 0.00               | 0.00     |      |      |
| Sulfur Dioxide                 | ----               | ----     |      |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |      |      |
| Formaldehyde                   | 0.94               | 0.52     |      |      |
| Acetaldehyde                   | 0.18               | 0.02     |      |      |
| Acetone                        | 0.00               | 0.00     |      |      |
| Isobutyraldehyde               | 0.00               | 0.43     |      |      |
| Methyl ethyl ketone            | 0.00               | 0.00     |      |      |
| Crotonaldehyde                 | --                 | --       |      |      |
| Hexanaldehyde                  | 0.00               | 0.00     |      |      |
| Benzaldehyde                   | --                 | --       |      |      |
| <u>Organic Sulfides</u>        |                    |          |      |      |
| Carbonyl sulfide               | 0.00               | 0.00     |      |      |
| Methyl sulfide                 | 0.00               | 0.02     |      |      |
| Ethyl sulfide                  | 0.00               | 0.00     |      |      |
| Methyl disulfide               | 0.00               | 0.01     |      |      |
| <u>Organic Amines</u>          |                    |          |      |      |
| Monomethylamine                | 0.00               | 0.00     |      |      |
| Monoethylamine & dimethylamine | 0.00               | 0.00     |      |      |
| Trimethylamine                 | 0.00               | 0.00     |      |      |
| Diethylamine                   | 0.00               | 0.00     |      |      |
| Triethylamine                  | 0.00               | 0.00     |      |      |
|                                |                    |          |      |      |
|                                | Emissions in ppm   |          |      |      |
|                                | COLD-UDDS          | HOT-UDDS |      |      |
|                                | 1                  | 2        | 3    | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |      |      |
| Methane                        | 8.38               | 2.54     | 3.20 | 2.29 |
| Ethylene                       | 4.93               | 0.05     | 0.81 | 0.03 |
| Ethane                         | 1.12               | 0.57     | 0.88 | 0.48 |
| Acetylene                      | 2.55               | 0.00     | 0.00 | 0.00 |
| Propane                        | 0.16               | 0.00     | 0.03 | 0.00 |
| Propylene                      | 2.05               | 0.00     | 0.21 | 0.00 |
| Benzene                        | 5.16               | 0.22     | 1.38 | 0.14 |
| Toluene                        | 7.80               | 0.00     | 0.65 | 0.00 |
| <u>Other</u>                   |                    |          |      |      |
| Nitrous Oxide                  | 0.75               | 0.49     | 1.84 | 0.60 |
| Nickel Carbonyl                | 0.00               | 0.00     | 0.00 | 0.00 |

TABLE C-16. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test No. 212221 - Fuel No. 2, 10,000 Miles

|                                | Emissions in mg/km |          |      |      |
|--------------------------------|--------------------|----------|------|------|
|                                | COLD-UDDS          | HOT-UDDS |      |      |
| Sulfates                       | 0.85               | 1.52     |      |      |
| Ammonia                        | 1.26               | 1.25     |      |      |
| Cyanides & Cyanogen            | 1.23               | 0.08     |      |      |
| Hydrogen Sulfide               | 0.00               | 0.00     |      |      |
| Sulfur Dioxide                 | ----               | ----     |      |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |      |      |
| Formaldehyde                   | 1.23               | 0.00     |      |      |
| Acetaldehyde                   | 0.00               | 0.34     |      |      |
| Acetone                        | 0.00               | 0.00     |      |      |
| Isobutyraldehyde               | 2.67               | 2.93     |      |      |
| Methyl ethyl ketone            | 0.00               | 0.00     |      |      |
| Crotonaldehyde                 | --                 | --       |      |      |
| Hexanaldehyde                  | 0.00               | 0.00     |      |      |
| Benzaldehyde                   | --                 | --       |      |      |
| <u>Organic Sulfides</u>        |                    |          |      |      |
| Carbonyl sulfide               | --                 | 0.31     |      |      |
| Methyl sulfide                 | 0.03               | 0.01     |      |      |
| Ethyl sulfide                  | 0.02               | 0.00     |      |      |
| Methyl disulfide               | 0.01               | 0.00     |      |      |
| <u>Organic Amines</u>          |                    |          |      |      |
| Monomethylamine                | 0.05               | --       |      |      |
| Monoethylamine & dimethylamine | 0.04               | --       |      |      |
| Trimethylamine                 | 0.00               | --       |      |      |
| Diethylamine                   | 0.00               | --       |      |      |
| Triethylamine                  | 0.00               | --       |      |      |
|                                | Emissions in ppm   |          |      |      |
|                                | COLD-UDDS          | HOT-UDDS |      |      |
|                                | 1                  | 2        | 3    | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |      |      |
| Methane                        | 8.84               | 3.77     | 4.09 | 2.99 |
| Ethylene                       | 5.11               | 0.13     | 0.90 | 0.08 |
| Ethane                         | 3.90               | 0.65     | 0.95 | 0.55 |
| Acetylene                      | 6.90               | 0.00     | 0.00 | 0.00 |
| Propane                        | 0.16               | 0.04     | 0.02 | 0.03 |
| Propylene                      | 2.13               | 0.00     | 0.20 | 0.00 |
| Benzene                        | 5.59               | 0.35     | 1.51 | 0.27 |
| Toluene                        | 8.97               | 0.00     | 1.24 | 0.00 |
| <u>Other</u>                   |                    |          |      |      |
| Nitrous Oxide                  | 0.73               | 0.51     | 1.79 | 0.48 |
| Nickel Carbonyl                | 0.00               | 0.00     | 0.00 | 0.00 |

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TABLE C-17. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test 212311, Fuel No. 3, 10,000 Miles

|                                | Emissions in mg/km |          |          |      |
|--------------------------------|--------------------|----------|----------|------|
|                                | COLD-UDDS          | HOT-UDDS |          |      |
| Sulfates                       | 0.11               | 2.09     |          |      |
| Ammonia                        | 2.67               | 1.51     |          |      |
| Cyanides & Cyanogen            | 1.39               | 1.59     |          |      |
| Hydrogen Sulfide               | 0.00               | 0.00     |          |      |
| Sulfur Dioxide                 | ----               | ----     |          |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |          |      |
| Formaldehyde                   | 2.69               | 3.75     |          |      |
| Acetaldehyde                   | 0.00               | 0.11     |          |      |
| Acetone                        | 0.00               | 0.00     |          |      |
| Isobutyraldehyde               | 0.00               | 0.00     |          |      |
| Methyl ethyl ketone            | 0.00               | 0.00     |          |      |
| Crotonaldehyde                 | --                 | --       |          |      |
| Hexanaldehyde                  | 0.00               | 0.00     |          |      |
| Benzaldehyde                   | --                 | --       |          |      |
| <u>Organic Sulfides</u>        |                    |          |          |      |
| Carbonyl sulfide               | 0.13               | 0.17     |          |      |
| Methyl sulfide                 | 0.00               | 0.00     |          |      |
| Ethyl sulfide                  | 0.01               | 0.00     |          |      |
| Methyl disulfide               | 0.02               | 0.00     |          |      |
| <u>Organic Amines</u>          |                    |          |          |      |
| Monomethylamine                | 0.01               | 0.00     |          |      |
| Monoethylamine & dimethylamine | 0.04               | 0.02     |          |      |
| Trimethylamine                 | 0.00               | 0.00     |          |      |
| Diethylamine                   | 0.00               | 0.00     |          |      |
| Triethylamine                  | 0.00               | 0.00     |          |      |
|                                |                    |          |          |      |
|                                | Emissions in ppm   |          |          |      |
|                                | COLD-UDDS          |          | HOT-UDDS |      |
|                                | 1                  | 2        | 3        | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |          |      |
| Methane                        | 9.41               | 4.52     | 6.88     | 6.87 |
| Ethylene                       | 4.85               | 0.10     | 2.15     | 0.60 |
| Ethane                         | 1.48               | 0.78     | 1.41     | 1.01 |
| Acetylene                      | 2.41               | 0.00     | 0.00     | 0.00 |
| Propane                        | 0.18               | 0.02     | 0.32     | 0.19 |
| Propylene                      | 2.25               | 0.00     | 0.54     | 0.03 |
| Benzene                        | 1.71               | 0.16     | 0.39     | 0.48 |
| Toluene                        | 1.69               | 0.00     | 0.18     | 0.03 |
| <u>Other</u>                   |                    |          |          |      |
| Nitrous Oxide                  | 1.15               | 0.45     | 1.77     | 0.50 |
| Nickel Carbonyl                | 0.00               | 0.00     | 0.00     | 0.00 |

TABLE C-18. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test 212321, Fuel No. 3, 10,000 Miles

|                                | Emissions in mg/km |          |
|--------------------------------|--------------------|----------|
|                                | COLD-UDDS          | HOT-UDDS |
| <u>Sulfates</u>                | 0.42               | 2.53     |
| <u>Ammonia</u>                 | 1.16               | 4.04     |
| <u>Cyanides &amp; Cyanogen</u> | 0.00               | 0.32     |
| <u>Hydrogen Sulfide</u>        | 0.00               | 0.00     |
| <u>Sulfur Dioxide</u>          | ----               | ----     |
| <u>Aldehydes &amp; Ketones</u> |                    |          |
| Formaldehyde                   | 0.86               | 1.44     |
| Acetaldehyde                   | 0.69               | 0.42     |
| Acetone                        | 0.00               | 0.00     |
| Isobutyraldehyde               | 1.99               | 0.00     |
| Methyl ethyl ketone            | 0.00               | 0.00     |
| Crotonaldehyde                 | ----               | ----     |
| Hexanaldehyde                  | 0.00               | 0.00     |
| Benzaldehyde                   | ----               | ----     |
| <u>Organic Sulfides</u>        |                    |          |
| Carbonyl sulfide               | 0.00               | 0.00     |
| Methyl sulfide                 | 0.00               | 0.00     |
| Ethyl sulfide                  | 0.00               | 0.00     |
| Methyl disulfide               | 0.01               | 0.00     |
| <u>Organic Amines</u>          |                    |          |
| Monomethylamine                | 0.00               | 0.02     |
| Monoethylamine & dimethylamine | 0.04               | 0.01     |
| Trimethylamine                 | 0.00               | 0.00     |
| Diethylamine                   | 0.00               | 0.00     |
| Triethylamine                  | 0.00               | 0.00     |

|                                | Emissions in ppm |      |          |      |
|--------------------------------|------------------|------|----------|------|
|                                | COLD-UDDS        |      | HOT-UDDS |      |
|                                | 1                | 2    | 3        | 4    |
| <u>Individual Hydrocarbons</u> |                  |      |          |      |
| Methane                        | 10.75            | 5.18 | 6.75     | 8.62 |
| Ethylene                       | 5.92             | 0.14 | 1.59     | 1.15 |
| Ethane                         | 1.52             | 0.84 | 1.40     | 1.24 |
| Acetylene                      | 3.23             | 0.00 | 0.00     | 0.00 |
| Propane                        | 0.21             | 0.10 | 0.32     | 0.19 |
| Propylene                      | 2.67             | 0.00 | 0.46     | 0.15 |
| Benzene                        | 2.35             | 0.15 | 0.30     | 0.67 |
| Toluene                        | 1.89             | 0.05 | 0.10     | 0.20 |
| <u>Other</u>                   |                  |      |          |      |
| Nitrous Oxide                  | 0.98             | 0.49 | 1.72     | 0.52 |
| Nickel Carbonyl                | 0.00             | 0.00 | 0.00     | 0.00 |

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TABLE C-19. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS

Test 213111 - Fuel No. 1, 15,000 Miles

|                                | Emissions in mg/km |          |      |      |
|--------------------------------|--------------------|----------|------|------|
|                                | COLD-UDDS          | HOT-UDDS |      |      |
| Sulfates                       | 0.21               | 0.08     |      |      |
| Ammonia                        | 3.34               | 1.98     |      |      |
| Cyanides & Cyanogen            | 3.00               | 0.72     |      |      |
| Hydrogen Sulfide               | 0.00               | 0.00     |      |      |
| Sulfur Dioxide                 | 8.17               | 12.64    |      |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |      |      |
| Formaldehyde                   | 0.00               | 0.51     |      |      |
| Acetaldehyde                   | 0.08               | 0.31     |      |      |
| Acetone                        | 0.00               | 0.00     |      |      |
| Isobutyraldehyde               | 8.29               | 13.55    |      |      |
| Methyl ethyl ketone            | 0.00               | 0.00     |      |      |
| Crotonaldehyde                 | ----               | ----     |      |      |
| Hexanaldehyde                  | 0.00               | 0.53     |      |      |
| Benzaldehyde                   | ----               | ----     |      |      |
| <u>Organic Sulfides</u>        |                    |          |      |      |
| Carbonyl sulfide               | 0.00               | 0.00     |      |      |
| Methyl sulfide                 | 0.00               | 0.00     |      |      |
| Ethyl sulfide                  | 0.00               | 0.00     |      |      |
| Methyl disulfide               | 0.00               | 0.00     |      |      |
| <u>Organic Amines</u>          |                    |          |      |      |
| Monomethylamine                | 0.03               | 0.00     |      |      |
| Monoethylamine & dimethylamine | 0.00               | 0.00     |      |      |
| Trimethylamine                 | 0.00               | 0.00     |      |      |
| Diethylamine                   | 0.00               | 0.00     |      |      |
| Triethylamine                  | 0.00               | 0.00     |      |      |
| <u>Emissions in ppm</u>        |                    |          |      |      |
|                                | COLD-UDDS          | HOT-UDDS |      |      |
|                                | 1                  | 2        | 3    | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |      |      |
| Methane                        | 10.79              | 4.06     | 3.09 | 3.21 |
| Ethylene                       | 5.71               | 0.12     | 0.82 | 0.05 |
| Ethane                         | 1.20               | 0.68     | 0.68 | 0.57 |
| Acetylene                      | 3.40               | 0.00     | 0.00 | 0.00 |
| Propane                        | 1.10               | 0.81     | 0.31 | 0.24 |
| Propylene                      | 2.34               | 0.00     | 0.13 | 0.00 |
| Benzene                        | 6.21               | 0.15     | 0.87 | 0.10 |
| Toluene                        | 8.56               | 0.05     | 0.39 | 0.00 |
| <u>Other</u>                   |                    |          |      |      |
| Nitrous Oxide                  | 0.32               | 0.14     | 1.24 | 0.34 |
| Nickel Carbonyl                | 0.00               | 0.00     | 0.00 | 0.00 |

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TABLE C-20. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS

Test 213121 - Fuel No. 1, 15,000 Miles

|                                | Emissions in mg/km |          |      |      |
|--------------------------------|--------------------|----------|------|------|
|                                | COLD-UDDS          | HOT-UDDS |      |      |
| Sulfates                       | 0.23               | 0.10     |      |      |
| Ammonia                        | 1.97               | 1.24     |      |      |
| Cyanides & Cyanogen            | 2.07               | 1.67     |      |      |
| Hydrogen Sulfide               | 0.00               | 0.00     |      |      |
| Sulfur Dioxide                 | 16.31              | 8.37     |      |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |      |      |
| Formaldehyde                   | 1.99               | 0.91     |      |      |
| Acetaldehyde                   | 0.68               | 0.44     |      |      |
| Acetone                        | 0.00               | 0.00     |      |      |
| Isobutyraldehyde               | 2.04               | 0.46     |      |      |
| Methyl ethyl ketone            | 0.00               | 0.00     |      |      |
| Crotonaldehyde                 | ----               | ----     |      |      |
| Hexanaldehyde                  | 0.00               | 0.00     |      |      |
| Benzaldehyde                   | ----               | ----     |      |      |
| <u>Organic Sulfides</u>        |                    |          |      |      |
| Carbonyl sulfide               | 0.00               | 0.39     |      |      |
| Methyl sulfide                 | 0.00               | 0.00     |      |      |
| Ethyl sulfide                  | 0.01               | 0.00     |      |      |
| Methyl disulfide               | 0.01               | 0.00     |      |      |
| <u>Organic Amines</u>          |                    |          |      |      |
| Monomethylamine                | 0.03               | 0.01     |      |      |
| Monoethylamine & dimethylamine | 0.00               | 0.00     |      |      |
| Trimethylamine                 | 0.00               | 0.00     |      |      |
| Diethylamine                   | 0.00               | 0.00     |      |      |
| Triethylamine                  | 0.00               | 0.00     |      |      |
| <u>Emissions in ppm</u>        |                    |          |      |      |
|                                | COLD-UDDS          | HOT-UDDS |      |      |
|                                | 1                  | 2        | 3    | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |      |      |
| Methane                        | 11.11              | 4.19     | 3.51 | 2.81 |
| Ethylene                       | 5.08               | 0.02     | 0.96 | 0.05 |
| Ethane                         | 1.10               | 0.64     | 0.91 | 0.62 |
| Acetylene                      | 3.12               | 0.00     | 0.00 | 0.00 |
| Propane                        | 0.12               | 0.02     | 0.03 | 0.02 |
| Propylene                      | 1.85               | 0.00     | 0.05 | 0.00 |
| Benzene                        | 5.33               | 0.26     | 1.30 | 0.25 |
| Toluene                        | 7.88               | 0.00     | 0.35 | 0.00 |
| <u>Other</u>                   |                    |          |      |      |
| Nitrous Oxide                  | 0.71               | 0.29     | 1.53 | 0.48 |
| Nickel Carbonyl                | ----               | ----     | ---- | ---- |

TABLE C-21. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test 213211 - Fuel No. 2, 15,000 Miles

|                                | Emissions in mg/km |          |          |      |
|--------------------------------|--------------------|----------|----------|------|
|                                | COLD-UDDS          | HOT-UDDS |          |      |
| Sulfates                       | 0.01               | 0.11     |          |      |
| Ammonia                        | 2.00               | 2.53     |          |      |
| Cyanides & Cyanogen            | 3.22               | 0.26     |          |      |
| Hydrogen Sulfide               | 0.00               | 0.00     |          |      |
| Sulfur Dioxide                 | 22.48              | 31.18    |          |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |          |      |
| Formaldehyde                   | 1.70               | 0.23     |          |      |
| Acetaldehyde                   | 0.20               | 0.00     |          |      |
| Acetone                        | 0.00               | 0.00     |          |      |
| Isobutyraldehyde               | 9.11               | 10.28    |          |      |
| Methyl ethyl ketone            | 0.00               | 0.00     |          |      |
| Crotonaldehyde                 | ---                | ---      |          |      |
| Hexanaldehyde                  | 0.00               | 0.00     |          |      |
| Benzaldehyde                   | ---                | ---      |          |      |
| <u>Organic Sulfides</u>        |                    |          |          |      |
| Carbonyl sulfide               | 0.00               | 0.00     |          |      |
| Methyl sulfide                 | 0.00               | 0.00     |          |      |
| Ethyl sulfide                  | 0.12               | 0.00     |          |      |
| Methyl disulfide               | 0.03               | 0.03     |          |      |
| <u>Organic Amines</u>          |                    |          |          |      |
| Monomethylamine                | 0.02               | 0.06     |          |      |
| Monoethylamine & dimethylamine | 0.02               | 0.03     |          |      |
| Trimethylamine                 | 0.00               | 0.00     |          |      |
| Diethylamine                   | 0.00               | 0.00     |          |      |
| Triethylamine                  | 0.00               | 0.00     |          |      |
| <u>Emissions in ppm</u>        |                    |          |          |      |
|                                | COLD-UDDS          |          | HOT-UDDS |      |
|                                | 1                  | 2        | 3        | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |          |      |
| Methane                        | 8.41               | 2.61     | 3.46     | 2.39 |
| Ethylene                       | 5.07               | 0.05     | 0.92     | 0.04 |
| Ethane                         | 1.15               | 0.50     | 0.90     | 0.48 |
| Acetylene                      | 2.19               | 0.00     | 0.00     | 0.00 |
| Propane                        | 0.22               | 0.01     | 0.08     | 0.01 |
| Propylene                      | 2.19               | 0.00     | 0.26     | 0.00 |
| Benzene                        | 5.53               | 0.10     | 1.32     | 0.05 |
| Toluene                        | 8.59               | 0.00     | 0.35     | 0.00 |
| <u>Other</u>                   |                    |          |          |      |
| Nitrous Oxide                  | 0.61               | 0.33     | 1.90     | 0.35 |
| Nickel Carbonyl                | 0.00               | 0.00     | 0.00     | 0.00 |



TABLE C-22. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS

Test 213221 - Fuel No. 2, 15,000 Miles

|                                | Emissions in mg/km |          |          |      |
|--------------------------------|--------------------|----------|----------|------|
|                                | COLD-UDDS          | HOT-UDDS |          |      |
| Sulfates                       | 0.70               | 0.31     |          |      |
| Ammonia                        | 1.58               | 1.73     |          |      |
| Cyanides & Cyanogen            | 1.98               | 0.08     |          |      |
| Hydrogen Sulfide               | 0.00               | 0.00     |          |      |
| Sulfur Dioxide                 | 25.55              | 28.65    |          |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |          |      |
| Formaldehyde                   | 1.47               | 0.00     |          |      |
| Acetaldehyde                   | 0.45               | 0.15     |          |      |
| Acetone                        | 0.00               | 0.00     |          |      |
| Isobutyraldehyde               | 4.54               | 0.00     |          |      |
| Methyl ethyl ketone            | 0.00               | 0.00     |          |      |
| Crotonaldehyde                 | ----               | ----     |          |      |
| Hexanaldehyde                  | 0.00               | 0.00     |          |      |
| Benzaldehyde                   | ----               | ----     |          |      |
| <u>Organic Sulfides</u>        |                    |          |          |      |
| Carbonyl sulfide               | 0.00               | 0.00     |          |      |
| Methyl sulfide                 | 0.00               | 0.00     |          |      |
| Ethyl sulfide                  | 0.00               | 0.00     |          |      |
| Methyl disulfide               | 0.00               | 0.00     |          |      |
| <u>Organic Amines</u>          |                    |          |          |      |
| Monomethylamine                | 0.00               | 0.00     |          |      |
| Monoethylamine & dimethylamine | 0.08               | 0.04     |          |      |
| Trimethylamine                 | 0.00               | 0.00     |          |      |
| Diethylamine                   | 0.00               | 0.00     |          |      |
| Triethylamine                  | 0.00               | 0.00     |          |      |
| <u>Emissions in ppm</u>        |                    |          |          |      |
|                                | COLD-UDDS          |          | HOT-UDDS |      |
|                                | 1                  | 1        | 3        | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |          |      |
| Methane                        | 9.94               | 2.48     | 3.66     | 2.22 |
| Ethylene                       | 6.36               | 0.04     | 1.16     | 0.02 |
| Ethane                         | 1.20               | 0.47     | 0.83     | 0.41 |
| Acetylene                      | 3.36               | 0.00     | 0.00     | 0.00 |
| Propane                        | 0.00               | 0.00     | 0.00     | 0.00 |
| Propylene                      | 2.55               | 0.00     | 0.40     | 0.00 |
| Benzene                        | 6.84               | 0.00     | 1.61     | 0.00 |
| Toluene                        | 9.45               | 0.03     | 0.97     | 0.00 |
| <u>Other</u>                   |                    |          |          |      |
| Nitrous Oxide                  | 0.71               | 0.36     | 1.72     | 0.38 |
| Nickel Carbonyl                | ----               | ----     | ----     | ---- |

TABLE C-23. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test 213311 - Fuel No. 3, 15,000 Miles

|                                | Emissions in mg/km |          |      |      |
|--------------------------------|--------------------|----------|------|------|
|                                | COLD-UDDS          | HOT-UDDS |      |      |
| Sulfates                       | 2.33               | 6.58     |      |      |
| Ammonia                        | 3.27               | 1.40     |      |      |
| Cyanides & Cyanogen            | 1.80               | 0.33     |      |      |
| Hydrogen Sulfide               | 0.00               | 0.00     |      |      |
| Sulfur Dioxide                 | 21.66              | 15.34    |      |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |      |      |
| Formaldehyde                   | 2.16               | 1.66     |      |      |
| Acetaldehyde                   | 0.61               | 0.33     |      |      |
| Acetone                        | 0.00               | 0.00     |      |      |
| Isobutyraldehyde               | 4.44               | 7.76     |      |      |
| Methyl ethyl ketone            | 0.00               | 0.00     |      |      |
| Crotonaldehyde                 | ----               | ----     |      |      |
| Hexanaldehyde                  | 1.08               | 2.51     |      |      |
| Benzaldehyde                   | ----               | ----     |      |      |
| <u>Organic Sulfides</u>        |                    |          |      |      |
| Carbonyl sulfide               | 0.00               | 0.00     |      |      |
| Methyl sulfide                 | 0.07               | 0.00     |      |      |
| Ethyl sulfide                  | 0.00               | 0.00     |      |      |
| Methyl disulfide               | 0.01               | 0.00     |      |      |
| <u>Organic Amines</u>          |                    |          |      |      |
| Monomethylamine                | 0.01               | 0.01     |      |      |
| Monoethylamine & dimethylamine | 0.07               | 0.06     |      |      |
| Trimethylamine                 | 0.00               | 0.00     |      |      |
| Diethylamine                   | 0.00               | 0.00     |      |      |
| Triethylamine                  | 0.00               | 0.00     |      |      |
| <u>Emissions in ppm</u>        |                    |          |      |      |
|                                | COLD-UDDS          | HOT-UDDS |      |      |
|                                | 1                  | 2        | 3    | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |      |      |
| Methane                        | 9.66               | 2.64     | 3.80 | 2.47 |
| Ethylene                       | 5.09               | 0.02     | 0.49 | 0.01 |
| Ethane                         | 1.39               | 0.59     | 0.98 | 0.56 |
| Acetylene                      | 2.35               | 0.00     | 0.00 | 0.00 |
| Propane                        | 0.23               | 0.00     | 0.08 | 0.02 |
| Propylene                      | 3.09               | 0.00     | 0.00 | 0.00 |
| Benzene                        | 2.33               | 0.00     | 0.15 | 0.00 |
| Toluene                        | 2.39               | 0.00     | 0.00 | 0.00 |
| <u>Other</u>                   |                    |          |      |      |
| Nitrous Oxide                  | 0.97               | 0.37     | 1.46 | 0.44 |
| Nickel Carbonyl                | 0.00               | 0.00     | 0.00 | 0.00 |

TABLE C-24. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS

Test 213321 - Fuel No. 3, 15,000 Miles

|                                | Emissions in mg/km |          |          |      |
|--------------------------------|--------------------|----------|----------|------|
|                                | COLD-UDDS          | HOT-UDDS |          |      |
| Sulfates                       | 0.27               | 71.26    |          |      |
| Ammonia                        | 1.65               | 3.16     |          |      |
| Cyanides & Cyanogen            | 1.27               | 0.15     |          |      |
| Hydrogen Sulfide               | ----               | ----     |          |      |
| Sulfur Dioxide                 | 47.47              | 21.18    |          |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |          |      |
| Formaldehyde                   | 3.34               | 2.61     |          |      |
| Acetaldehyde                   | 0.85               | 0.30     |          |      |
| Acetone                        | 0.00               | 0.00     |          |      |
| Isobutyraldehyde               | 1.26               | 0.00     |          |      |
| Methyl ethyl ketone            | 0.00               | 0.00     |          |      |
| Crotonaldehyde                 | ----               | ----     |          |      |
| Hexanaldehyde                  | 0.74               | 0.58     |          |      |
| Benzaldehyde                   | ----               | ----     |          |      |
| <u>Organic Sulfides</u>        |                    |          |          |      |
| Carbonyl sulfide               | 0.00               | 0.00     |          |      |
| Methyl sulfide                 | 0.00               | 0.02     |          |      |
| Ethyl sulfide                  | 0.00               | 0.00     |          |      |
| Methyl disulfide               | 0.00               | 0.00     |          |      |
| <u>Organic Amines</u>          |                    |          |          |      |
| Monomethylamine                | 0.00               | 0.01     |          |      |
| Monoethylamine & dimethylamine | 0.06               | 0.00     |          |      |
| Trimethylamine                 | 0.00               | 0.00     |          |      |
| Diethylamine                   | 0.00               | 0.00     |          |      |
| Triethylamine                  | 0.00               | 0.00     |          |      |
| <u>Emissions in ppm</u>        |                    |          |          |      |
|                                | COLD-UDDS          |          | HOT-UDDS |      |
|                                | 1                  | 2        | 3        | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |          |      |
| Methane                        | 11.61              | 2.91     | 4.31     | 2.71 |
| Ethylene                       | 6.55               | 0.05     | 0.89     | 0.01 |
| Ethane                         | 1.45               | 0.61     | 1.10     | 0.57 |
| Acetylene                      | 3.45               | 0.00     | 0.00     | 0.00 |
| Propane                        | 0.23               | 0.01     | 0.10     | 0.00 |
| Propylene                      | 2.59               | 0.00     | 0.21     | 0.00 |
| Benzene                        | 2.89               | 0.00     | 0.22     | 0.00 |
| Toluene                        | 2.70               | 0.00     | 0.15     | 0.00 |
| <u>Other</u>                   |                    |          |          |      |
| Nitrous Oxide                  | 0.76               | 0.33     | 1.71     | ---- |
| Nickel Carbonyl                | 0.00               | 0.00     | 0.00     | 0.00 |

TABLE C-25. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test 220111 - Fuel No. 1, 0 Miles

|                                | Emissions in mg/km |          |      |      |
|--------------------------------|--------------------|----------|------|------|
|                                | COLD-UDDS          | HOT-UDDS |      |      |
| Sulfates                       | 0.01               | 0.00     |      |      |
| Ammonia                        | 2.90               | 3.22     |      |      |
| Cyanides & Cyanogen            | 2.12               | 0.50     |      |      |
| Hydrogen Sulfide               | 0.00               | 0.00     |      |      |
| Sulfur Dioxide                 | ----               | ----     |      |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |      |      |
| Formaldehyde                   | 1.06               | 0.05     |      |      |
| Acetaldehyde                   | 0.00               | 0.00     |      |      |
| Acetone                        | 0.00               | 0.00     |      |      |
| Isobutyraldehyde               | 0.00               | 0.00     |      |      |
| Methyl ethyl ketone            | 0.16               | 0.16     |      |      |
| Crotonaldehyde                 | ----               | ----     |      |      |
| Hexanaldehyde                  | 0.00               | 0.00     |      |      |
| Benzaldehyde                   | ----               | ----     |      |      |
| <u>Organic Sulfides</u>        |                    |          |      |      |
| Carbonyl sulfide               | 0.14               | 0.13     |      |      |
| Methyl sulfide                 | 0.00               | 0.00     |      |      |
| Ethyl sulfide                  | 0.00               | 0.00     |      |      |
| Methyl disulfide               | 0.00               | 0.00     |      |      |
| <u>Organic Amines</u>          |                    |          |      |      |
| Monomethylamine                | 0.00               | 0.00     |      |      |
| Monoethylamine & dimethylamine | 0.00               | 0.00     |      |      |
| Trimethylamine                 | 0.00               | 0.00     |      |      |
| Diethylamine                   | 0.00               | 0.00     |      |      |
| Triethylamine                  | 0.00               | 0.00     |      |      |
|                                | Emissions in ppm   |          |      |      |
|                                | COLD-UDDS          | HOT-UDDS |      |      |
|                                | 1                  | 2        | 3    | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |      |      |
| Methane                        | 6.90               | 0.69     | 3.71 | 0.64 |
| Ethylene                       | 8.78               | 0.19     | 1.80 | 0.10 |
| Ethane                         | 1.14               | 0.14     | 0.58 | 0.10 |
| Acetylene                      | 3.32               | 0.00     | 0.00 | 0.00 |
| Propane                        | 0.33               | 0.02     | 0.27 | 0.01 |
| Propylene                      | 4.38               | 0.00     | 0.71 | 0.00 |
| Benzene                        | 8.62               | 0.15     | 3.55 | 0.08 |
| Toluene                        | 13.27              | 0.25     | 3.41 | 0.00 |
| <u>Other</u>                   |                    |          |      |      |
| Nitrous Oxide                  | 2.23               | 0.20     | 1.11 | 0.16 |
| Nickel Carbonyl                | 0.00               | 0.00     | 0.00 | 0.00 |

TABLE C-26. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test 220121 - Fuel No. 1, 0 Miles

|                                | Emissions in mg/km |          |      |      |
|--------------------------------|--------------------|----------|------|------|
|                                | COLD-UDDS          | HOT-UDDS |      |      |
| Sulfates                       | 0.00               | 0.00     |      |      |
| Ammonia                        | 0.15               | 0.88     |      |      |
| Cyanides & Cyanogen            | 2.15               | 0.68     |      |      |
| Hydrogen Sulfide               | 0.00               | 0.00     |      |      |
| Sulfur Dioxide                 | ----               | ----     |      |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |      |      |
| Formaldehyde                   | 0.39               | 0.00     |      |      |
| Acetaldehyde                   | 0.00               | 0.00     |      |      |
| Acetone                        | 0.23               | 0.00     |      |      |
| Isobutyraldehyde               | 0.10               | 0.52     |      |      |
| Methyl ethyl ketone            | 0.00               | 0.00     |      |      |
| Crotonaldehyde                 | ----               | ----     |      |      |
| Hexanaldehyde                  | 0.00               | 0.00     |      |      |
| Benzaldehyde                   | ----               | ----     |      |      |
| <u>Organic Sulfides</u>        |                    |          |      |      |
| Carbonyl sulfide               | 0.00               | 0.00     |      |      |
| Methyl sulfide                 | 0.00               | 0.00     |      |      |
| Ethyl sulfide                  | 0.00               | 0.00     |      |      |
| Methyl disulfide               | 0.00               | 0.00     |      |      |
| <u>Organic Amines</u>          |                    |          |      |      |
| Monomethylamine                | 0.00               | 0.00     |      |      |
| Monoethylamine & dimethylamine | 0.00               | 0.00     |      |      |
| Trimethylamine                 | 0.00               | 0.00     |      |      |
| Diethylamine                   | 0.00               | 0.00     |      |      |
| Triethylamine                  | 0.00               | 0.00     |      |      |
|                                | Emissions in ppm   |          |      |      |
|                                | COLD-UDDS          | HOT-UDDS |      |      |
|                                | 1                  | 2        | 3    | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |      |      |
| Methane                        | 6.75               | 0.63     | 3.80 | 0.58 |
| Ethylene                       | 9.87               | 0.30     | 1.72 | 0.14 |
| Ethane                         | 1.10               | 0.17     | 0.60 | 0.15 |
| Acetylene                      | 3.84               | 0.00     | 0.00 | 0.00 |
| Propane                        | 0.24               | 0.01     | 0.25 | 0.00 |
| Propylene                      | 4.79               | 0.00     | 0.64 | 0.00 |
| Benzene                        | 9.89               | 0.36     | 3.30 | 0.10 |
| Toluene                        | 15.32              | 0.41     | 3.03 | 0.05 |
| <u>Other</u>                   |                    |          |      |      |
| Nitrous Oxide                  | 1.83               | 0.17     | 0.79 | 0.28 |
| Nickel Carbonyl                | 0.00               | 0.00     | 0.00 | 0.00 |

TABLE C-27. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test 220211 - Fuel No. 2, 0 Miles

|                                | Emissions in mg/km |          |      |      |
|--------------------------------|--------------------|----------|------|------|
|                                | COLD-UDDS          | HOT-UDDS |      |      |
| Sulfates                       | 0.10               | 0.02     |      |      |
| Ammonia                        | 2.67               | 1.23     |      |      |
| Cyanides & Cyanogen            | 5.08               | 3.13     |      |      |
| Hydrogen Sulfide               | 0.09               | 0.00     |      |      |
| Sulfur Dioxide                 | ----               | ----     |      |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |      |      |
| Formaldehyde                   | 0.00               | 0.05     |      |      |
| Acetaldehyde                   | 0.00               | 0.00     |      |      |
| Acetone                        | 0.00               | 0.00     |      |      |
| Isobutyraldehyde               | 0.00               | 0.00     |      |      |
| Methyl ethyl ketone            | 0.13               | 0.00     |      |      |
| Crotonaldehyde                 | ----               | ----     |      |      |
| Hexanaldehyde                  | 0.00               | 0.00     |      |      |
| Benzaldehyde                   | ----               | ----     |      |      |
| <u>Organic Sulfides</u>        |                    |          |      |      |
| Carbonyl sulfide               | 0.02               | 0.00     |      |      |
| Methyl sulfide                 | 0.03               | 0.00     |      |      |
| Ethyl sulfide                  | 0.05               | 0.00     |      |      |
| Methyl disulfide               | 0.00               | 0.00     |      |      |
| <u>Organic Amines</u>          |                    |          |      |      |
| Monomethylamine                | 0.00               | 0.02     |      |      |
| Monoethylamine & dimethylamine | 0.00               | 0.01     |      |      |
| Trimethylamine                 | 0.00               | 0.00     |      |      |
| Diethylamine                   | 0.00               | 0.00     |      |      |
| Triethylamine                  | 0.00               | 0.00     |      |      |
| <u>Emissions in ppm</u>        |                    |          |      |      |
|                                | COLD-UDDS          | HOT-UDDS |      |      |
|                                | 1                  | 2        | 3    | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |      |      |
| Methane                        | 6.95               | 0.19     | 2.72 | 0.40 |
| Ethylene                       | 9.78               | 0.17     | 2.38 | 0.10 |
| Ethane                         | 1.13               | 0.03     | 0.47 | 0.05 |
| Acetylene                      | 4.36               | 0.00     | 0.00 | 0.00 |
| Propane                        | 0.36               | 0.14     | 0.15 | 0.06 |
| Propylene                      | 4.95               | 0.00     | 1.01 | 0.00 |
| Benzene                        | 9.79               | 0.10     | 3.22 | 0.05 |
| Toluene                        | 15.53              | 0.05     | 3.45 | 0.00 |
| <u>Other</u>                   |                    |          |      |      |
| Nitrous Oxide                  | 1.52               | 0.15     | 1.22 | 0.31 |
| Nickel Carbonyl                | 0.00               | 0.00     | 0.00 | 0.00 |

TABLE C-28. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test 220221 - Fuel No. 2, 0 Miles

|                                | Emissions in mg/km |          |      |      |
|--------------------------------|--------------------|----------|------|------|
|                                | COLD-UDDS          | HOT-UDDS |      |      |
| Sulfates                       | 0.08               | 0.03     |      |      |
| Ammonia                        | 2.94               | 5.26     |      |      |
| Cyanides & Cyanogen            | 0.31               | 2.67     |      |      |
| Hydrogen Sulfide               | 0.09               | 0.00     |      |      |
| Sulfur Dioxide                 | ----               | ----     |      |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |      |      |
| Formaldehyde                   | 0.19               | 0.00     |      |      |
| Acetaldehyde                   | 0.00               | 0.00     |      |      |
| Acetone                        | 0.00               | 0.19     |      |      |
| Isobutyraldehyde               | 0.00               | 0.00     |      |      |
| Methyl ethyl ketone            | 0.00               | 0.00     |      |      |
| Crotonaldehyde                 | ----               | ----     |      |      |
| Hexanaldehyde                  | 0.00               | 0.00     |      |      |
| Benzaldehyde                   | ----               | ----     |      |      |
| <u>Organic Sulfides</u>        |                    |          |      |      |
| Carbonyl sulfide               | 0.31               | 0.06     |      |      |
| Methyl sulfide                 | 0.16               | 0.05     |      |      |
| Ethyl sulfide                  | 0.00               | 0.00     |      |      |
| Methyl disulfide               | 0.01               | 0.00     |      |      |
| <u>Organic Amines</u>          |                    |          |      |      |
| Monomethylamine                | 0.00               | 0.00     |      |      |
| Monoethylamine & dimethylamine | 0.00               | 0.00     |      |      |
| Trimethylamine                 | 0.00               | 0.00     |      |      |
| Diethylamine                   | 0.00               | 0.00     |      |      |
| Triethylamine                  | 0.00               | 0.00     |      |      |
|                                | Emissions in ppm   |          |      |      |
|                                | COLD-UDDS          | HOT-UDDS |      |      |
|                                | 1                  | 2        | 3    | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |      |      |
| Methane                        | 6.17               | 0.00     | 2.38 | 0.44 |
| Ethylene                       | 8.75               | 0.30     | 2.68 | 0.11 |
| Ethane                         | 0.85               | 0.07     | 0.46 | 0.08 |
| Acetylene                      | 4.17               | 0.08     | 1.09 | 0.00 |
| Propane                        | 0.36               | 0.11     | 0.14 | 0.05 |
| Propylene                      | 4.15               | 0.00     | 1.09 | 0.00 |
| Benzene                        | 8.61               | 0.04     | 3.11 | 0.00 |
| Toluene                        | 3.90               | 0.00     | 3.42 | 0.00 |
| <u>Other</u>                   |                    |          |      |      |
| Nitrous Oxide                  | 1.57               | 0.11     | 1.03 | 0.23 |
| Nickel Carbonyl                | 0.00               | 0.00     | 0.00 | 0.00 |



TABLE C-29. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test 220311 - Fuel #3, Initial Mileage

|                                | Emissions in mg/km |          |      |      |
|--------------------------------|--------------------|----------|------|------|
|                                | COLD-UDDS          | HOT-UDDS |      |      |
| Sulfates                       | 0.19               | 0.10     |      |      |
| Ammonia                        | 7.56               | 2.36     |      |      |
| Cyanides & Cyanogen            | 4.70               | 2.29     |      |      |
| Hydrogen Sulfide               | 0.00               | 0.00     |      |      |
| Sulfur Dioxide                 | ----               | ----     |      |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |      |      |
| Formaldehyde                   | 0.00               | 0.44     |      |      |
| Acetaldehyde                   | 0.00               | 0.00     |      |      |
| Acetone                        | 0.00               | 0.00     |      |      |
| Isobutyraldehyde               | 0.00               | 0.00     |      |      |
| Methyl ethyl ketone            | 0.00               | 0.00     |      |      |
| Crotonaldehyde                 | ----               | ----     |      |      |
| Hexanaldehyde                  | 0.00               | 0.00     |      |      |
| Benzaldehyde                   | ----               | ----     |      |      |
| <u>Organic Sulfides</u>        |                    |          |      |      |
| Carbonyl sulfide               | 0.09               | 0.29     |      |      |
| Methyl sulfide                 | 0.02               | 0.01     |      |      |
| Ethyl sulfide                  | 0.00               | 0.00     |      |      |
| Methyl disulfide               | 0.00               | 0.00     |      |      |
| <u>Organic Amines</u>          |                    |          |      |      |
| Monomethylamine                | 0.00               | 0.01     |      |      |
| Monoethylamine & dimethylamine | 0.00               | 0.00     |      |      |
| Trimethylamine                 | 0.00               | 0.00     |      |      |
| Diethylamine                   | 0.00               | 0.00     |      |      |
| Triethylamine                  | 0.00               | 0.00     |      |      |
|                                | Emissions in ppm   |          |      |      |
|                                | COLD-UDDS          | HOT-UDDS |      |      |
|                                | 1                  | 2        | 3    | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |      |      |
| Methane                        | 6.47               | 0.18     | 8.73 | 0.77 |
| Ethylene                       | 8.08               | 0.14     | 6.23 | 0.08 |
| Ethane                         | 1.02               | 0.09     | 0.83 | 0.15 |
| Acetylene                      | 3.86               | 0.00     | 0.05 | 0.00 |
| Propane                        | 0.18               | 0.00     | 0.25 | 0.00 |
| Propylene                      | 4.45               | 0.00     | 2.22 | 0.00 |
| Benzene                        | 2.75               | 0.00     | 1.67 | 0.00 |
| Toluene                        | 2.56               | 0.00     | 1.32 | 0.00 |
| <u>Other</u>                   |                    |          |      |      |
| Nitrous Oxide                  | 2.29               | 0.11     | 0.75 | 0.07 |
| Nickel Carbonyl                | 0.00               | 0.00     | 0.00 | 0.00 |

TABLE C-30. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test 220321 - Fuel #3, Initial Mileage

|                                | Emissions in mg/km |          |
|--------------------------------|--------------------|----------|
|                                | COLD-UDDS          | HOT-UDDS |
| Sulfates                       | 0.06               | 0.03     |
| Ammonia                        | 2.48               | 1.81     |
| Cyanides & Cyanogen            | 4.52               | 1.87     |
| Hydrogen Sulfide               | 0.00               | 0.00     |
| Sulfur Dioxide                 | ----               | ----     |
| <u>Aldehydes &amp; Ketones</u> |                    |          |
| Formaldehyde                   | 0.20               | 0.30     |
| Acetaldehyde                   | 0.00               | 0.00     |
| Acetone                        | 0.00               | 0.00     |
| Isobutyraldehyde               | 0.00               | 0.00     |
| Methyl ethyl ketone            | 0.41               | 0.00     |
| Crotonaldehyde                 | ----               | ----     |
| Hexanaldehyde                  | 0.00               | 0.00     |
| Benzaldehyde                   | ----               | ----     |
| <u>Organic Sulfides</u>        |                    |          |
| Carbonyl sulfide               | 0.07               | 0.08     |
| Methyl sulfide                 | 0.03               | 0.02     |
| Ethyl sulfide                  | 0.06               | 0.00     |
| Methyl disulfide               | 0.04               | 0.00     |
| <u>Organic Amines</u>          |                    |          |
| Monomethylamine                | 0.00               | 0.00     |
| Monoethylamine & dimethylamine | 0.00               | 0.00     |
| Trimethylamine                 | 0.00               | 0.00     |
| Diethylamine                   | 0.00               | 0.00     |
| Triethylamine                  | 0.00               | 0.00     |

|                                | Emissions in ppm |      |          |      |
|--------------------------------|------------------|------|----------|------|
|                                | COLD-UDDS        |      | HOT-UDDS |      |
|                                | 1                | 2    | 3        | 4    |
| <u>Individual Hydrocarbons</u> |                  |      |          |      |
| Methane                        | 8.24             | 0.05 | 7.12     | 0.69 |
| Ethylene                       | 10.04            | 0.06 | 5.34     | 0.04 |
| Ethane                         | 1.20             | 0.10 | 0.82     | 0.12 |
| Acetylene                      | 5.72             | 0.02 | 0.10     | 0.00 |
| Propane                        | 0.17             | 0.00 | 0.22     | 0.05 |
| Propylene                      | 5.40             | 0.00 | 2.23     | 0.00 |
| Benzene                        | 3.96             | 0.00 | 1.65     | 0.00 |
| Toluene                        | 3.25             | 0.02 | 1.26     | 0.03 |
| <u>Other</u>                   |                  |      |          |      |
| Nitrous Oxide                  | 1.75             | 0.07 | 1.12     | 0.09 |
| Nickel Carbonyl                | 0.00             | 0.00 | 0.00     | 0.00 |

TABLE C-31. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS

Test 221111 - Fuel No. 1, 5000 Miles

|                                | Emissions in mg/km |          |          |      |
|--------------------------------|--------------------|----------|----------|------|
|                                | COLD-UDDS          | HOT-UDDS |          |      |
| Sulfates                       | 0.20               | 0.05     |          |      |
| Ammonia                        | 1.65               | 4.59     |          |      |
| Cyanides & Cyanogen            | 2.09               | 1.66     |          |      |
| Hydrogen Sulfide               | 0.00               | 0.00     |          |      |
| Sulfur Dioxide                 | ----               | ----     |          |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |          |      |
| Formaldehyde                   | 1.99               | 0.44     |          |      |
| Acetaldehyde                   | 0.31               | 0.00     |          |      |
| Acetone                        | 0.00               | 0.00     |          |      |
| Isobutyraldehyde               | 0.57               | 0.38     |          |      |
| Methyl ethyl ketone            | 0.00               | 0.00     |          |      |
| Crotonaldehyde                 | ----               | ----     |          |      |
| Hexanaldehyde                  | 0.00               | 0.00     |          |      |
| Benzaldehyde                   | ----               | ----     |          |      |
| <u>Organic Sulfides</u>        |                    |          |          |      |
| Carbonyl sulfide               | 0.03               | 0.02     |          |      |
| Methyl sulfide                 | 0.01               | 0.02     |          |      |
| Ethyl sulfide                  | ----               | 0.06     |          |      |
| Methyl disulfide               | ----               | 0.00     |          |      |
| <u>Organic Amines</u>          |                    |          |          |      |
| Monomethylamine                | 0.01               | 0.00     |          |      |
| Monoethylamine & dimethylamine | 0.01               | 0.01     |          |      |
| Trimethylamine                 | 0.00               | 0.00     |          |      |
| Diethylamine                   | 0.00               | 0.00     |          |      |
| Triethylamine                  | 0.00               | 0.00     |          |      |
| Emissions in ppm               |                    |          |          |      |
|                                | COLD-UDDS          |          | HOT-UDDS |      |
|                                | 1                  | 2        | 3        | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |          |      |
| Methane                        | 10.93              | 1.67     | 7.00     | 1.64 |
| Ethylene                       | 10.33              | 0.10     | 6.28     | 0.05 |
| Ethane                         | 1.29               | 0.33     | 0.99     | 0.25 |
| Acetylene                      | 6.10               | 0.00     | 0.02     | 0.00 |
| Propane                        | 0.26               | 0.00     | 0.40     | 0.00 |
| Propylene                      | 5.18               | 0.00     | 2.77     | 0.00 |
| Benzene                        | 11.45              | 0.18     | 6.35     | 0.15 |
| Toluene                        | 16.24              | 0.09     | 7.87     | 0.23 |
| <u>Other</u>                   |                    |          |          |      |
| Nitrous Oxide                  | 3.16               | 0.34     | 2.22     | 0.25 |
| Nickel Carbonyl                | ----               | ----     | ----     | ---- |

TABLE C-32. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test 221121 - Fuel No. 1, 5000 Miles

|                                | Emissions in mg/km |          |      |      |
|--------------------------------|--------------------|----------|------|------|
|                                | COLD-UDDS          | HOT-UDDS |      |      |
| Sulfates                       | 0.38               | 0.05     |      |      |
| Ammonia                        | 11.69              | 8.87     |      |      |
| Cyanides & Cyanogen            | 2.06               | 1.90     |      |      |
| Hydrogen Sulfide               | 0.00               | 0.00     |      |      |
| Sulfur Dioxide                 | ----               | ----     |      |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |      |      |
| Formaldehyde                   | 2.82               | 0.00     |      |      |
| Acetaldehyde                   | 0.92               | 0.00     |      |      |
| Acetone                        | 0.00               | 0.00     |      |      |
| Isobutyraldehyde               | 0.22               | 0.27     |      |      |
| Methyl ethyl ketone            | 0.00               | 0.00     |      |      |
| Crotonaldehyde                 | ----               | ----     |      |      |
| Hexanaldehyde                  | 0.00               | 0.00     |      |      |
| Benzaldehyde                   | ----               | ----     |      |      |
| <u>Organic Sulfides</u>        |                    |          |      |      |
| Carbonyl sulfide               | 0.00               | 0.00     |      |      |
| Methyl sulfide                 | 0.03               | 0.01     |      |      |
| Ethyl sulfide                  | 0.65               | 0.01     |      |      |
| Methyl disulfide               | 0.05               | 0.00     |      |      |
| <u>Organic Amines</u>          |                    |          |      |      |
| Monomethylamine                | 0.00               | 0.00     |      |      |
| Monoethylamine & dimethylamine | 0.03               | 0.03     |      |      |
| Trimethylamine                 | 0.00               | 0.00     |      |      |
| Diethylamine                   | 0.00               | 0.00     |      |      |
| Triethylamine                  | 0.00               | 0.00     |      |      |
|                                | Emissions in ppm   |          |      |      |
|                                | COLD-UDDS          | HOT-UDDS |      |      |
|                                | 1                  | 2        | 3    | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |      |      |
| Methane                        | 12.74              | 3.41     | 8.11 | 2.74 |
| Ethylene                       | 11.97              | 0.45     | 7.49 | 0.08 |
| Ethane                         | 1.46               | 0.40     | 1.11 | 0.29 |
| Acetylene                      | 6.78               | 0.00     | 0.10 | 0.00 |
| Propane                        | 0.33               | 0.00     | 0.36 | 0.00 |
| Propylene                      | 6.18               | 0.00     | 3.44 | 0.00 |
| Benzene                        | 11.99              | 0.31     | 7.08 | 0.14 |
| Toluene                        | 19.20              | 0.27     | 9.67 | 0.12 |
| <u>Other</u>                   |                    |          |      |      |
| Nitrous Oxide                  | 2.12               | 0.39     | 1.66 | 0.50 |
| Nickel Carbonyl                | 0.00               | 0.00     | 0.00 | 0.00 |

TABLE C-33. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test 221211 - Fuel No. 2, 5000 Miles

|                                | Emissions in mg/km |          |      |      |
|--------------------------------|--------------------|----------|------|------|
|                                | COLD-UDDS          | HOT-UDDS |      |      |
| Sulfates                       | 0.21               | 0.04     |      |      |
| Ammonia                        | 2.19               | 3.24     |      |      |
| Cyanides & Cyanogen            | 8.23               | 3.36     |      |      |
| Hydrogen Sulfide               | 0.00               | 0.00     |      |      |
| Sulfur Dioxide                 | ----               | ----     |      |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |      |      |
| Formaldehyde                   | 1.24               | 0.06     |      |      |
| Acetaldehyde                   | 0.60               | 0.47     |      |      |
| Acetone                        | 0.27               | 0.00     |      |      |
| Isobutyraldehyde               | 0.00               | 0.00     |      |      |
| Methyl ethyl ketone            | 0.00               | 0.00     |      |      |
| Crotonaldehyde                 | ----               | ----     |      |      |
| Hexanaldehyde                  | 0.00               | 0.00     |      |      |
| Benzaldehyde                   | ----               | ----     |      |      |
| <u>Organic Sulfides</u>        |                    |          |      |      |
| Carbonyl sulfide               | 0.25               | 0.67     |      |      |
| Methyl sulfide                 | 0.04               | 0.06     |      |      |
| Ethyl sulfide                  | 0.02               | 0.00     |      |      |
| Methyl disulfide               | 0.01               | 0.03     |      |      |
| <u>Organic Amines</u>          |                    |          |      |      |
| Monomethylamine                | 0.00               | 0.00     |      |      |
| Monoethylamine & dimethylamine | 0.01               | 0.01     |      |      |
| Trimethylamine                 | 0.00               | 0.00     |      |      |
| Diethylamine                   | 0.00               | 0.00     |      |      |
| Triethylamine                  | 0.00               | 0.00     |      |      |
|                                | Emissions in ppm   |          |      |      |
|                                | COLD-UDDS          | HOT-UDDS |      |      |
|                                | 1                  | 2        | 3    | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |      |      |
| Methane                        | 9.75               | 1.64     | 2.64 | 1.46 |
| Ethylene                       | 9.12               | 0.06     | 0.30 | 0.02 |
| Ethane                         | 1.20               | 0.29     | 0.60 | 0.25 |
| Acetylene                      | 8.03               | 0.00     | 0.00 | 0.00 |
| Propane                        | 0.14               | 0.00     | 0.06 | 0.00 |
| Propylene                      | 4.61               | 0.00     | 0.05 | 0.00 |
| Benzene                        | 9.91               | 0.10     | 0.44 | 0.12 |
| Toluene                        | 16.88              | 0.04     | 0.14 | 0.00 |
| <u>Other</u>                   |                    |          |      |      |
| Nitrous Oxide                  | 3.80               | 0.25     | 1.00 | 0.23 |
| Nickel Carbonyl                | 0.00               | 0.00     | 0.00 | 0.00 |

TABLE C-34. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test 221221 - Fuel No. 2, 5000 Miles

|                                | Emissions in mg/km |          |      |      |
|--------------------------------|--------------------|----------|------|------|
|                                | COLD-UDDS          | HOT-UDDS |      |      |
| Sulfates                       | 0.12               | 0.00     |      |      |
| Ammonia                        | 0.00               | 0.24     |      |      |
| Cyanides & Cyanogen            | 4.10               | 2.53     |      |      |
| Hydrogen Sulfide               | 0.00               | 0.00     |      |      |
| Sulfur Dioxide                 | ----               | ----     |      |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |      |      |
| Formaldehyde                   | 1.10               | 0.56     |      |      |
| Acetaldehyde                   | 0.00               | 0.00     |      |      |
| Acetone                        | 0.00               | 0.00     |      |      |
| Isobutyraldehyde               | 3.19               | 6.02     |      |      |
| Methyl ethyl ketone            | 0.00               | 0.00     |      |      |
| Crotonaldehyde                 | ----               | ----     |      |      |
| Hexanaldehyde                  | 0.00               | 0.00     |      |      |
| Benzaldehyde                   | ----               | ----     |      |      |
| <u>Organic Sulfides</u>        |                    |          |      |      |
| Carbonyl sulfide               | 0.12               | 0.04     |      |      |
| Methyl sulfide                 | 0.00               | 0.02     |      |      |
| Ethyl sulfide                  | 0.05               | 0.00     |      |      |
| Methyl disulfide               | 0.01               | 0.00     |      |      |
| <u>Organic Amines</u>          |                    |          |      |      |
| Monomethylamine                | 0.00               | 0.00     |      |      |
| Monoethylamine & dimethylamine | 0.02               | 0.01     |      |      |
| Trimethylamine                 | 0.00               | 0.00     |      |      |
| Diethylamine                   | 0.00               | 0.00     |      |      |
| Triethylamine                  | 0.00               | 0.00     |      |      |
|                                | Emissions in ppm   |          |      |      |
|                                | COLD-UDDS          | HOT-UDDS |      |      |
|                                | 1                  | 2        | 3    | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |      |      |
| Methane                        | 8.37               | 1.77     | 3.31 | 1.65 |
| Ethylene                       | 9.53               | 0.03     | 0.85 | 0.01 |
| Ethane                         | 1.24               | 0.32     | 0.74 | 0.27 |
| Acetylene                      | 5.75               | 0.00     | 0.00 | 0.00 |
| Propane                        | 0.10               | 0.00     | 0.01 | 0.00 |
| Propylene                      | 4.95               | 0.00     | 0.33 | 0.00 |
| Benzene                        | 9.16               | 0.10     | 1.32 | 0.08 |
| Toluene                        | 14.27              | 0.08     | 1.08 | 0.02 |
| <u>Other</u>                   |                    |          |      |      |
| Nitrous Oxide                  | 2.56               | 0.23     | 1.54 | 0.17 |
| Nickel Carbonyl                | 0.00               | 0.00     | 0.00 | 0.00 |

TABLE C-35. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test 221311 - Fuel No. 3, 5000 Miles

|                                | Emissions in mg/km |          |
|--------------------------------|--------------------|----------|
|                                | COLD-UDDS          | HOT-UDDS |
| Sulfates                       | 0.11               | 0.00     |
| Ammonia                        | 5.95               | 2.25     |
| Cyanides & Cyanogen            | 2.73               | 2.31     |
| Hydrogen Sulfide               | 0.00               | 0.00     |
| Sulfur Dioxide                 | ----               | ----     |
| <u>Aldehydes &amp; Ketones</u> |                    |          |
| Formaldehyde                   | 1.31               | 0.58     |
| Acetaldehyde                   | 0.00               | 0.00     |
| Acetone                        | 0.00               | 0.00     |
| Isobutyraldehyde               | 4.48               | 0.68     |
| Methyl ethyl ketone            | 0.00               | 0.00     |
| Crotonaldehyde                 | ----               | ----     |
| Hexanaldehyde                  | 0.00               | 0.00     |
| Benzaldehyde                   | ----               | ----     |
| <u>Organic Sulfides</u>        |                    |          |
| Carbonyl sulfide               | 0.42               | 0.00     |
| Methyl sulfide                 | 0.00               | 0.04     |
| Ethyl sulfide                  | 0.02               | 0.00     |
| Methyl disulfide               | 0.00               | 0.00     |
| <u>Organic Amines</u>          |                    |          |
| Monomethylamine                | 0.01               | 0.01     |
| Monoethylamine & dimethylamine | 0.02               | 0.01     |
| Trimethylamine                 | 0.00               | 0.00     |
| Diethylamine                   | 0.00               | 0.00     |
| Triethylamine                  | 0.00               | 0.00     |

|                                | Emissions in ppm |      |          |      |
|--------------------------------|------------------|------|----------|------|
|                                | COLD-UDDS        |      | HOT-UDDS |      |
|                                | 1                | 2    | 3        | 4    |
| <u>Individual Hydrocarbons</u> |                  |      |          |      |
| Methane                        | 11.39            | 1.19 | 7.97     | 1.18 |
| Ethylene                       | 11.25            | 0.03 | 3.19     | 0.00 |
| Ethane                         | 1.64             | 0.21 | 1.04     | 0.18 |
| Acetylene                      | 8.06             | 0.00 | 0.19     | 0.00 |
| Propane                        | 0.17             | 0.00 | 0.06     | 0.00 |
| Propylene                      | 6.47             | 0.00 | 1.00     | 0.00 |
| Benzene                        | 4.05             | 0.08 | 1.04     | 0.00 |
| Toluene                        | 3.57             | 0.00 | 0.47     | 0.00 |
| <u>Other</u>                   |                  |      |          |      |
| Nitrous Oxide                  | 2.81             | 0.13 | 1.19     | 0.11 |
| Nickel Carbonyl                | 0.00             | 0.00 | 0.00     | 0.00 |



TABLE C-36. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test 221321 - Fuel No. 3, 5000 Miles

|                                | Emissions in mg/km |          |
|--------------------------------|--------------------|----------|
|                                | COLD-UDDS          | HOT-UDDS |
| Sulfates                       | 0.15               | 0.07     |
| Ammonia                        | 3.47               | 5.81     |
| Cyanides & Cyanogen            | 3.36               | 1.68     |
| Hydrogen Sulfide               | 0.00               | 0.00     |
| Sulfur Dioxide                 | ----               | ----     |
| <u>Aldehydes &amp; Ketones</u> |                    |          |
| Formaldehyde                   | 1.67               | 0.00     |
| Acetaldehyde                   | 0.49               | 0.35     |
| Acetone                        | 0.00               | 0.00     |
| Isobutyraldehyde               | 0.00               | 1.45     |
| Methyl ethyl ketone            | 0.00               | 0.00     |
| Crotonaldehyde                 | ----               | ----     |
| Hexanaldehyde                  | 0.00               | 0.00     |
| Benzaldehyde                   | ----               | ----     |
| <u>Organic Sulfides</u>        |                    |          |
| Carbonyl sulfide               | 0.00               | 0.00     |
| Methyl sulfide                 | 0.00               | 0.00     |
| Ethyl sulfide                  | 0.00               | 0.00     |
| Methyl disulfide               | 0.00               | 0.00     |
| <u>Organic Amines</u>          |                    |          |
| Monomethylamine                | 0.00               | 0.00     |
| Monoethylamine & dimethylamine | 0.02               | 0.02     |
| Trimethylamine                 | 0.00               | 0.00     |
| Diethylamine                   | 0.00               | 0.00     |
| Triethylamine                  | 0.00               | 0.00     |

|                                | Emissions in ppm |      |          |      |
|--------------------------------|------------------|------|----------|------|
|                                | COLD-UDDS        |      | HOT-UDDS |      |
|                                | 1                | 2    | 3        | 4    |
| <u>Individual Hydrocarbons</u> |                  |      |          |      |
| Methane                        | 12.83            | 1.30 | 4.18     | 0.22 |
| Ethylene                       | 11.12            | 0.02 | 0.91     | 0.00 |
| Ethane                         | 1.72             | 0.24 | 0.83     | 0.22 |
| Acetylene                      | 10.51            | 0.00 | 0.00     | 0.00 |
| Propane                        | 0.00             | 0.00 | 0.02     | 0.00 |
| Propylene                      | 5.95             | 0.00 | 0.41     | 0.00 |
| Benzene                        | 3.66             | 0.00 | 0.38     | 0.00 |
| Toluene                        | 3.44             | 0.00 | 0.00     | 0.00 |
| <u>Other</u>                   |                  |      |          |      |
| Nitrous Oxide                  | 2.49             | 0.12 | 1.19     | 0.19 |
| Nickel Carbonyl                | 0.00             | 0.00 | 0.00     | 0.00 |

TABLE C-37. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS

Test 222111 - Fuel No. 1, 10,000 Miles

|                                | Emissions in mg/km |          |
|--------------------------------|--------------------|----------|
|                                | COLD-UDDS          | HOT-UDDS |
| Sulfates                       | 0.09               | 0.00     |
| Ammonia                        | 5.15               | 2.65     |
| Cyanides & Cyanogen            | 4.05               | 2.70     |
| Hydrogen Sulfide               | 0.00               | 0.00     |
| Sulfur Dioxide                 | ----               | ----     |
| <u>Aldehydes &amp; Ketones</u> |                    |          |
| Formaldehyde                   | 0.00               | 0.17     |
| Acetaldehyde                   | 0.35               | 0.62     |
| Acetone                        | 0.00               | 0.00     |
| Isobutyraldehyde               | 0.00               | 1.91     |
| Methyl ethyl ketone            | 0.00               | 0.00     |
| Crotonaldehyde                 | ----               | ----     |
| Hexanaldehyde                  | 0.00               | 0.00     |
| Benzaldehyde                   | ----               | ----     |
| <u>Organic Sulfides</u>        |                    |          |
| Carbonyl sulfide               | 0.98               | 0.17     |
| Methyl sulfide                 | 0.01               | 0.05     |
| Ethyl sulfide                  | 0.00               | 0.00     |
| Methyl disulfide               | 0.00               | 0.02     |
| <u>Organic Amines</u>          |                    |          |
| Monomethylamine                | 0.02               | 0.00     |
| Monoethylamine & dimethylamine | 0.07               | 0.00     |
| Trimethylamine                 | 0.00               | 0.00     |
| Diethylamine                   | 0.00               | 0.00     |
| Triethylamine                  | 0.00               | 0.00     |

|                                | Emissions in ppm |      |          |      |
|--------------------------------|------------------|------|----------|------|
|                                | COLD-UDDS        |      | HOT-UDDS |      |
|                                | 1                | 2    | 3        | 4    |
| <u>Individual Hydrocarbons</u> |                  |      |          |      |
| Methane                        | 11.59            | 1.95 | 3.80     | 1.72 |
| Ethylene                       | 3.78             | 0.08 | 0.53     | 0.05 |
| Ethane                         | 1.39             | 0.38 | 0.82     | 0.29 |
| Acetylene                      | 6.09             | 0.00 | 0.00     | 0.00 |
| Propane                        | 0.26             | 0.03 | 0.08     | 0.00 |
| Propylene                      | 4.90             | 0.00 | 0.16     | 0.00 |
| Benzene                        | 9.44             | 0.10 | 0.74     | 0.15 |
| Toluene                        | 15.75            | 0.30 | 0.48     | 0.08 |
| <u>Other</u>                   |                  |      |          |      |
| Nitrous Oxide                  | ----             | ---- | ----     | ---- |
| Nickel Carbonyl                | ----             | ---- | ----     | ---- |

TABLE C-38. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS

Test 222121 - Fuel No. 1, 10,000 Miles

|                                | Emissions in mg/km |          |      |      |
|--------------------------------|--------------------|----------|------|------|
|                                | COLD-UDDS          | HOT-UDDS |      |      |
| Sulfates                       | 0.02               | 0.03     |      |      |
| Ammonia                        | 5.03               | 1.96     |      |      |
| Cyanides & Cyanogen            | 4.46               | 1.99     |      |      |
| Hydrogen Sulfide               | 0.00               | 0.00     |      |      |
| Sulfur Dioxide                 | 24.80              | 2.29     |      |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |      |      |
| Formaldehyde                   | 0.85               | 0.00     |      |      |
| Acetaldehyde                   | 0.74               | 0.31     |      |      |
| Acetone                        | 0.00               | 1.11     |      |      |
| Isobutyraldehyde               | 3.74               | 2.63     |      |      |
| Methyl ethyl ketone            | 0.00               | 0.00     |      |      |
| Crotonaldehyde                 | ----               | ----     |      |      |
| Hexanaldehyde                  | 0.00               | 0.00     |      |      |
| Benzaldehyde                   | ----               | ----     |      |      |
| <u>Organic Sulfides</u>        |                    |          |      |      |
| Carbonyl sulfide               | 0.14               | 0.00     |      |      |
| Methyl sulfide                 | 0.00               | 0.02     |      |      |
| Ethyl sulfide                  | 0.00               | 0.00     |      |      |
| Methyl disulfide               | 0.00               | 0.00     |      |      |
| <u>Organic Amines</u>          |                    |          |      |      |
| Monomethylamine                | 0.01               | 0.00     |      |      |
| Monoethylamine & dimethylamine | 0.12               | 0.01     |      |      |
| Trimethylamine                 | 0.00               | 0.01     |      |      |
| Diethylamine                   | 0.00               | 0.00     |      |      |
| Triethylamine                  | 0.00               | 0.00     |      |      |
| <u>Emissions in ppm</u>        |                    |          |      |      |
|                                | COLD-UDDS          | HOT-UDDS |      |      |
|                                | 1                  | 2        | 3    | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |      |      |
| Methane                        | 10.42              | 1.86     | 3.62 | 1.76 |
| Ethylene                       | 9.80               | 0.05     | 0.63 | 0.03 |
| Ethane                         | 1.45               | 0.37     | 0.86 | 0.30 |
| Acetylene                      | 4.98               | 0.00     | 0.00 | 0.00 |
| Propane                        | 0.19               | 0.01     | 0.01 | 0.00 |
| Propylene                      | 5.17               | 0.00     | 0.27 | 0.00 |
| Benzene                        | 10.53              | 0.24     | 1.13 | 0.13 |
| Toluene                        | 18.00              | 0.28     | 0.56 | 0.02 |
| <u>Other</u>                   |                    |          |      |      |
| Nitrous Oxide                  | 2.42               | 0.25     | 1.30 | 0.16 |
| Nickel Carbonyl                | 0.00               | 0.00     | 0.00 | 0.00 |

TABLE C-39. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test 222211 - Fuel No. 2, 10,000 Miles

|                                | Emissions in mg/km |          |      |      |
|--------------------------------|--------------------|----------|------|------|
|                                | COLD-UDDS          | HOT-UDDS |      |      |
| Sulfates                       | ----               | 0.03     |      |      |
| Ammonia                        | 2.65               | 1.46     |      |      |
| Cyanides & Cyanogen            | 3.66               | 2.89     |      |      |
| Hydrogen Sulfide               | 0.00               | 0.00     |      |      |
| Sulfur Dioxide                 | 6.99               | 10.67    |      |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |      |      |
| Formaldehyde                   | 2.29               | 1.06     |      |      |
| Acetaldehyde                   | 1.00               | 0.92     |      |      |
| Acetone                        | 0.00               | 0.29     |      |      |
| Isobutyraldehyde               | 0.90               | 0.00     |      |      |
| Methyl ethyl ketone            | 0.00               | 0.00     |      |      |
| Crotonaldehyde                 | ----               | ----     |      |      |
| Hexanaldehyde                  | 0.00               | 0.00     |      |      |
| Benzaldehyde                   | ----               | ----     |      |      |
| <u>Organic Sulfides</u>        |                    |          |      |      |
| Carbonyl sulfide               | 0.39               | 0.05     |      |      |
| Methyl sulfide                 | 0.00               | 0.06     |      |      |
| Ethyl sulfide                  | 0.00               | 0.00     |      |      |
| Methyl disulfide               | 0.00               | 0.03     |      |      |
| <u>Organic Amines</u>          |                    |          |      |      |
| Monomethylamine                | 0.06               | 0.03     |      |      |
| Monoethylamine & dimethylamine | 0.10               | 0.01     |      |      |
| Trimethylamine                 | 0.00               | 0.00     |      |      |
| Diethylamine                   | 0.00               | 0.00     |      |      |
| Triethylamine                  | 0.00               | 0.00     |      |      |
|                                | Emissions in ppm   |          |      |      |
|                                | COLD-UDDS          | HOT-UDDS |      |      |
|                                | 1                  | 2        | 3    | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |      |      |
| Methane                        | 11.60              | 1.93     | 3.53 | 1.80 |
| Ethylene                       | 10.63              | 0.12     | 0.70 | 0.05 |
| Ethane                         | 1.45               | 0.36     | 0.86 | 0.34 |
| Acetylene                      | 6.44               | 0.00     | 0.00 | 0.00 |
| Propane                        | 0.22               | 0.03     | 0.09 | 0.00 |
| Propylene                      | 5.22               | 0.02     | 0.31 | 0.00 |
| Benzene                        | 12.42              | 0.20     | 0.96 | 0.23 |
| Toluene                        | 21.33              | 1.49     | 0.64 | 0.08 |
| <u>Other</u>                   |                    |          |      |      |
| Nitrous Oxide                  | 2.77               | 0.28     | 1.41 | 0.25 |
| Nickel Carbonyl                | 0.00               | 0.00     | 0.00 | 0.00 |

TABLE C-40. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS

Test 222221 - Fuel No. 2, 10,000 Miles

|                                | Emissions in mg/km |          |
|--------------------------------|--------------------|----------|
|                                | COLD-UDDS          | HOT-UDDS |
| Sulfates                       | 0.04               | 0.02     |
| Ammonia                        | 5.94               | 4.95     |
| Cyanides & Cyanogen            | 7.48               | 4.69     |
| Hydrogen Sulfide               | 0.00               | 0.00     |
| Sulfur Dioxide                 | 7.68               | 29.49    |
| <u>Aldehydes &amp; Ketones</u> |                    |          |
| Formaldehyde                   | 0.60               | 0.00     |
| Acetaldehyde                   | 0.34               | 0.89     |
| Acetone                        | 0.00               | 0.00     |
| Isobutyraldehyde               | 5.72               | 2.45     |
| Methyl ethyl ketone            | 0.00               | 0.00     |
| Crotonaldehyde                 | ----               | ----     |
| Hexanaldehyde                  | 0.00               | 0.00     |
| Benzaldehyde                   | ----               | ----     |
| <u>Organic Sulfides</u>        |                    |          |
| Carbonyl sulfide               | 0.16               | 0.00     |
| Methyl sulfide                 | 0.01               | 0.00     |
| Ethyl sulfide                  | 0.00               | 0.00     |
| Methyl disulfide               | 0.00               | 0.01     |
| <u>Organic Amines</u>          |                    |          |
| Monomethylamine                | 0.00               | 0.03     |
| Monoethylamine & dimethylamine | 0.04               | 0.00     |
| Trimethylamine                 | 0.01               | 0.00     |
| Diethylamine                   | 0.00               | 0.00     |
| Triethylamine                  | 0.00               | 0.00     |

|                                | Emissions in ppm |      |          |      |
|--------------------------------|------------------|------|----------|------|
|                                | COLD-UDDS        |      | HOT-UDDS |      |
|                                | 1                | 2    | 3        | 4    |
| <u>Individual Hydrocarbons</u> |                  |      |          |      |
| Methane                        | 11.45            | 2.09 | 3.89     | 1.98 |
| Ethylene                       | 11.56            | 0.14 | 1.05     | 0.05 |
| Ethane                         | 1.52             | 0.42 | 0.91     | 0.35 |
| Acetylene                      | 5.92             | 0.00 | 0.00     | 0.00 |
| Propane                        | 0.14             | 0.00 | 0.01     | 0.00 |
| Propylene                      | 5.96             | 0.00 | 0.47     | 0.01 |
| Benzene                        | 16.67            | 0.35 | 1.56     | 0.22 |
| Toluene                        | 28.85            | 0.33 | 1.48     | 0.08 |
| <u>Other</u>                   |                  |      |          |      |
| Nitrous Oxide                  | 2.07             | 0.35 | 1.57     | 0.23 |
| Nickel Carbonyl                | 0.00             | 0.00 | 0.00     | 0.00 |

TABLE C-41. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test 222311 - Fuel No. 3, 10,000 Miles

|                                | Emissions in mg/km |          |
|--------------------------------|--------------------|----------|
|                                | COLD-UDDS          | HOT-UDDS |
| Sulfates                       | 0.06               | 0.04     |
| Ammonia                        | 5.75               | 6.50     |
| Cyanides & Cyanogen            | 6.16               | 3.65     |
| Hydrogen Sulfide               | 0.00               | 0.00     |
| Sulfur Dioxide                 | 3.47               | 9.54     |
| <u>Aldehydes &amp; Ketones</u> |                    |          |
| Formaldehyde                   | 0.48               | 0.45     |
| Acetaldehyde                   | 0.91               | 0.32     |
| Acetone                        | 0.00               | 0.00     |
| Isobutyraldehyde               | 8.05               | 12.60    |
| Methyl ethyl ketone            | 0.00               | 0.00     |
| Crotonaldehyde                 | ----               | ----     |
| Hexanaldehyde                  | 1.18               | 0.70     |
| Benzaldehyde                   | ----               | ----     |
| <u>Organic Sulfides</u>        |                    |          |
| Carbonyl sulfide               | 0.03               | 0.00     |
| Methyl sulfide                 | 0.00               | 0.00     |
| Ethyl sulfide                  | 0.00               | 0.00     |
| Methyl disulfide               | 0.00               | 0.00     |
| <u>Organic Amines</u>          |                    |          |
| Monomethylamine                | 0.00               | 0.03     |
| Monoethylamine & dimethylamine | 0.12               | 0.00     |
| Trimethylamine                 | 0.00               | 0.00     |
| Diethylamine                   | 0.00               | 0.00     |
| Triethylamine                  | 0.00               | 0.00     |

|                                | Emissions in ppm |      |          |      |
|--------------------------------|------------------|------|----------|------|
|                                | COLD-UDDS        |      | HOT-UDDS |      |
|                                | 1                | 2    | 3        | 4    |
| <u>Individual Hydrocarbons</u> |                  |      |          |      |
| Methane                        | 8.85             | 1.87 | 5.11     | 1.90 |
| Ethylene                       | 10.37            | 0.11 | 1.26     | 0.03 |
| Ethane                         | 1.88             | 0.39 | 1.08     | 0.33 |
| Acetylene                      | 3.01             | 0.00 | 0.00     | 0.00 |
| Propane                        | 0.00             | 0.00 | 0.00     | 0.00 |
| Propylene                      | 6.29             | 0.01 | 0.61     | 0.00 |
| Benzene                        | 3.24             | 0.03 | 0.53     | 0.00 |
| Toluene                        | 2.50             | 0.00 | 0.00     | 0.00 |
| <u>Other</u>                   |                  |      |          |      |
| Nitrous Oxide                  | 2.99             | 0.25 | 1.45     | 0.20 |
| Nickel Carbonyl                | 0.00             | 0.00 | 0.00     | 0.00 |

TABLE C-42. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test 222321 - Fuel No. 3, 10,000 Miles

|                                | Emissions in mg/km |          |      |      |
|--------------------------------|--------------------|----------|------|------|
|                                | COLD-UDDS          | HOT-UDDS |      |      |
| Sulfates                       | 0.10               | 0.02     |      |      |
| Ammonia                        | 4.53               | 6.66     |      |      |
| Cyanides & Cyanogen            | 5.78               | 3.94     |      |      |
| Hydrogen Sulfide               | 0.00               | 0.00     |      |      |
| Sulfur Dioxide                 | 2.53               | 8.23     |      |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |      |      |
| Formaldehyde                   | 1.22               | 0.00     |      |      |
| Acetaldehyde                   | 0.52               | 0.14     |      |      |
| Acetone                        | 0.00               | 0.00     |      |      |
| Isobutyraldehyde               | 1.99               | 1.41     |      |      |
| Methyl ethyl ketone            | 0.00               | 0.00     |      |      |
| Crotonaldehyde                 | ----               | ----     |      |      |
| Hexanaldehyde                  | 0.00               | 0.00     |      |      |
| Benzaldehyde                   | ----               | ----     |      |      |
| <u>Organic Sulfides</u>        |                    |          |      |      |
| Carbonyl sulfide               | 0.02               | 0.00     |      |      |
| Methyl sulfide                 | 0.00               | 0.00     |      |      |
| Ethyl sulfide                  | 0.03               | 0.00     |      |      |
| Methyl disulfide               | 0.01               | 0.00     |      |      |
| <u>Organic Amines</u>          |                    |          |      |      |
| Monomethylamine                | 0.03               | 0.03     |      |      |
| Monoethylamine & dimethylamine | 0.02               | 0.02     |      |      |
| Trimethylamine                 | 0.00               | 0.00     |      |      |
| Diethylamine                   | 0.00               | 0.00     |      |      |
| Triethylamine                  | 0.00               | 0.00     |      |      |
| <u>Emissions in ppm</u>        |                    |          |      |      |
|                                | COLD-UDDS          | HOT-UDDS |      |      |
|                                | 1                  | 2        | 3    | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |      |      |
| Methane                        | 11.89              | 2.10     | 5.18 | 1.76 |
| Ethylene                       | 12.66              | 0.10     | 1.60 | 0.10 |
| Ethane                         | 2.02               | 0.45     | 1.14 | 0.34 |
| Acetylene                      | 5.75               | 0.00     | 0.00 | 0.00 |
| Propane                        | 0.23               | 0.01     | 0.09 | 0.00 |
| Propylene                      | 7.12               | 0.01     | 0.79 | 0.00 |
| Benzene                        | 4.52               | 0.25     | 0.85 | 0.02 |
| Toluene                        | 5.36               | 1.51     | 1.30 | 0.10 |
| <u>Other</u>                   |                    |          |      |      |
| Nitrous Oxide                  | 2.27               | 0.27     | 1.32 | 0.12 |
| Nickel Carbonyl                | 0.00               | 0.00     | 0.00 | 0.00 |



TABLE C-43. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test 223111 - Fuel No. 1, 15,000 Miles

|                                | Emissions in mg/km |          |      |      |
|--------------------------------|--------------------|----------|------|------|
|                                | COLD-UDDS          | HOT-UDDS |      |      |
| Sulfates                       | 0.13               | 0.02     |      |      |
| Ammonia                        | 1.90               | 2.07     |      |      |
| Cyanides & Cyanogen            | 7.57               | 3.58     |      |      |
| Hydrogen Sulfide               | ----               | ----     |      |      |
| Sulfur Dioxide                 | 12.35              | 12.84    |      |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |      |      |
| Formaldehyde                   | 0.87               | 0.05     |      |      |
| Acetaldehyde                   | 0.00               | 0.00     |      |      |
| Acetone                        | 0.00               | 0.00     |      |      |
| Isobutyraldehyde               | 0.00               | 0.00     |      |      |
| Methyl ethyl ketone            | 0.00               | 0.00     |      |      |
| Crotonaldehyde                 | ----               | ----     |      |      |
| Hexanaldehyde                  | 0.00               | 0.00     |      |      |
| Benzaldehyde                   | ----               | ----     |      |      |
| <u>Organic Sulfides</u>        |                    |          |      |      |
| Carbonyl sulfide               | 0.09               | 0.00     |      |      |
| Methyl sulfide                 | 0.00               | 0.00     |      |      |
| Ethyl sulfide                  | 0.00               | 0.00     |      |      |
| Methyl disulfide               | 0.00               | 0.00     |      |      |
| <u>Organic Amines</u>          |                    |          |      |      |
| Monomethylamine                | 0.02               | 0.02     |      |      |
| Monoethylamine & dimethylamine | 0.02               | 0.03     |      |      |
| Trimethylamine                 | 0.00               | 0.00     |      |      |
| Diethylamine                   | 0.00               | 0.00     |      |      |
| Triethylamine                  | 0.00               | 0.00     |      |      |
| <u>Emissions in ppm</u>        |                    |          |      |      |
|                                | COLD-UDDS          | HOT-UDDS |      |      |
|                                | 1                  | 2        | 3    | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |      |      |
| Methane                        | 10.60              | 1.68     | 3.99 | 1.65 |
| Ethylene                       | 11.68              | 0.88     | 2.82 | 0.66 |
| Ethane                         | 1.18               | 0.42     | 0.74 | 0.37 |
| Acetylene                      | 5.98               | 0.00     | 0.01 | 0.00 |
| Propane                        | 0.23               | 0.02     | 0.14 | 0.01 |
| Propylene                      | 5.29               | 0.16     | 0.87 | 0.01 |
| Benzene                        | 28.41              | 2.36     | 7.84 | 1.65 |
| Toluene                        | 13.08              | 0.15     | 1.87 | 0.05 |
| <u>Other</u>                   |                    |          |      |      |
| Nitrous Oxide                  | 2.26               | 0.34     | 1.42 | 0.30 |
| Nickel Carbonyl                | 0.00               | 0.00     | 0.00 | 0.00 |

TABLE C-44. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test 223121 - Fuel No. 1, 15,000 Miles

|                                | Emissions in mg/km |          |
|--------------------------------|--------------------|----------|
|                                | COLD-UDDS          | HOT-UDDS |
| Sulfates                       | 0.16               | 0.11     |
| Ammonia                        | 4.70               | 1.74     |
| Cyanides & Cyanogen            | 5.67               | 3.71     |
| Hydrogen Sulfide               | ----               | ----     |
| Sulfur Dioxide                 | 11.54              | 14.99    |
| <u>Aldehydes &amp; Ketones</u> |                    |          |
| Formaldehyde                   | 1.98               | 0.35     |
| Acetaldehyde                   | 0.56               | 0.43     |
| Acetone                        | 0.11               | 0.00     |
| Isobutyraldehyde               | 3.97               | 4.01     |
| Methyl ethyl ketone            | 0.00               | 0.00     |
| Crotonaldehyde                 | ----               | ----     |
| Hexanaldehyde                  | 0.00               | 0.76     |
| Benzaldehyde                   | ----               | ----     |
| <u>Organic Sulfides</u>        |                    |          |
| Carbonyl sulfide               | 0.00               | 0.00     |
| Methyl sulfide                 | 0.00               | 0.01     |
| Ethyl sulfide                  | 0.00               | 0.00     |
| Methyl disulfide               | 0.00               | 0.00     |
| <u>Organic Amines</u>          |                    |          |
| Monomethylamine                | 0.05               | 0.04     |
| Monoethylamine & dimethylamine | 0.00               | 0.05     |
| Trimethylamine                 | 0.00               | 0.00     |
| Diethylamine                   | 0.00               | 0.00     |
| Triethylamine                  | 0.00               | 0.00     |

|                                | Emissions in ppm |      |          |      |
|--------------------------------|------------------|------|----------|------|
|                                | COLD-UDDS        |      | HOT-UDDS |      |
|                                | 1                | 2    | 3        | 4    |
| <u>Individual Hydrocarbons</u> |                  |      |          |      |
| Methane                        | 15.70            | 1.78 | 4.33     | 1.87 |
| Ethylene                       | 12.71            | 0.78 | 3.54     | 0.61 |
| Ethane                         | 1.48             | 0.45 | 0.84     | 0.39 |
| Acetylene                      | 10.80            | 0.00 | 0.00     | 0.00 |
| Propane                        | 0.32             | 0.02 | 0.13     | 0.01 |
| Propylene                      | 5.93             | 0.04 | 1.23     | 0.04 |
| Benzene                        | 27.05            | 1.63 | 7.48     | 1.33 |
| Toluene                        | 12.95            | 0.25 | 1.81     | 0.02 |
| <u>Other</u>                   |                  |      |          |      |
| Nitrous Oxide                  | 1.98             | 0.36 | 1.70     | 0.29 |
| Nickel Carbonyl                | ----             | ---- | ----     | ---- |

TABLE C-45. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test 223211 - Fuel No. 2, 15,000 Miles

|                                | Emissions in mg/km |          |
|--------------------------------|--------------------|----------|
|                                | COLD-UDDS          | HOT-UDDS |
| Sulfates                       | 0.18               | 0.01     |
| Ammonia                        | 0.61               | 0.26     |
| Cyanides & Cyanogen            | 5.94               | 3.50     |
| Hydrogen Sulfide               | -----              | -----    |
| Sulfur Dioxide                 | 20.82              | 14.79    |
| <u>Aldehydes &amp; Ketones</u> |                    |          |
| Formaldehyde                   | 1.58               | 0.00     |
| Acetaldehyde                   | 0.17               | 0.00     |
| Acetone                        | 0.00               | 0.00     |
| Isobutyraldehyde               | 0.00               | 0.00     |
| Methyl ethyl ketone            | 0.00               | 0.00     |
| Crotonaldehyde                 | -----              | -----    |
| Hexanaldehyde                  | 0.10               | 0.25     |
| Benzaldehyde                   | -----              | -----    |
| <u>Organic Sulfides</u>        |                    |          |
| Carbonyl sulfide               | 0.00               | 0.07     |
| Methyl sulfide                 | 0.00               | 0.00     |
| Ethyl sulfide                  | 0.06               | 0.00     |
| Methyl disulfide               | 0.05               | 0.03     |
| <u>Organic Amines</u>          |                    |          |
| Monomethylamine                | 0.00               | 0.00     |
| Monoethylamine & dimethylamine | 0.07               | 0.01     |
| Trimethylamine                 | 0.00               | 0.00     |
| Diethylamine                   | 0.00               | 0.00     |
| Triethylamine                  | 0.00               | 0.00     |

|                                | Emissions in ppm |      |          |      |
|--------------------------------|------------------|------|----------|------|
|                                | COLD-UDDS        |      | HOT-UDDS |      |
|                                | 1                | 2    | 3        | 4    |
| <u>Individual Hydrocarbons</u> |                  |      |          |      |
| Methane                        | 14.44            | 1.69 | 3.91     | 1.52 |
| Ethylene                       | 13.27            | 0.67 | 3.07     | 0.48 |
| Ethane                         | 1.44             | 0.48 | 0.86     | 0.43 |
| Acetylene                      | 10.78            | 0.00 | 0.00     | 0.00 |
| Propane                        | 0.58             | 0.79 | 0.58     | 0.23 |
| Propylene                      | 6.08             | 0.03 | 1.09     | 0.00 |
| Benzene                        | 24.85            | 1.04 | 5.44     | 0.32 |
| Toluene                        | 23.04            | 0.19 | 2.62     | 0.00 |
| <u>Other</u>                   |                  |      |          |      |
| Nitrous Oxide                  | 2.85             | 0.47 | 1.70     | 0.41 |
| Nickel Carbonyl                | 0.00             | 0.00 | 0.00     | 0.00 |

TABLE C-46. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test 223221 - Fuel No. 2, 15,000 Miles

|                                | Emissions in mg/km |          |      |      |
|--------------------------------|--------------------|----------|------|------|
|                                | COLD-UDDS          | HOT-UDDS |      |      |
| Sulfates                       | 0.06               | 0.01     |      |      |
| Ammonia                        | 2.57               | 1.94     |      |      |
| Cyanides & Cyanogen            | 7.32               | 3.41     |      |      |
| Hydrogen Sulfide               | 0.00               | 0.01     |      |      |
| Sulfur Dioxide                 | 24.21              | 20.46    |      |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |      |      |
| Formaldehyde                   | 3.63               | 0.58     |      |      |
| Acetaldehyde                   | 1.06               | 0.42     |      |      |
| Acetone                        | 0.00               | 0.00     |      |      |
| Isobutyraldehyde               | 0.00               | 0.00     |      |      |
| Methyl ethyl ketone            | 0.00               | 0.00     |      |      |
| Crotonaldehyde                 | ----               | ----     |      |      |
| Hexanaldehyde                  | 0.55               | 0.74     |      |      |
| Benzaldehyde                   | ----               | ----     |      |      |
| <u>Organic Sulfides</u>        |                    |          |      |      |
| Carbonyl sulfide               | 0.00               | 0.00     |      |      |
| Methyl sulfide                 | 0.00               | 0.00     |      |      |
| Ethyl sulfide                  | 0.00               | 0.00     |      |      |
| Methyl disulfide               | 0.00               | 0.00     |      |      |
| <u>Organic Amines</u>          |                    |          |      |      |
| Monomethylamine                | 0.01               | 0.00     |      |      |
| Monoethylamine & dimethylamine | 0.04               | 0.04     |      |      |
| Trimethylamine                 | 0.00               | 0.00     |      |      |
| Diethylamine                   | 0.00               | 0.00     |      |      |
| Triethylamine                  | 0.00               | 0.00     |      |      |
| <u>Emissions in ppm</u>        |                    |          |      |      |
|                                | COLD-UDDS          | HOT-UDDS |      |      |
|                                | 1                  | 2        | 3    | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |      |      |
| Methane                        | 18.88              | 1.98     | 4.40 | 1.71 |
| Ethylene                       | 14.22              | 0.60     | 2.61 | 0.50 |
| Ethane                         | 1.63               | 0.47     | 0.92 | 0.41 |
| Acetylene                      | 14.36              | 0.00     | 0.02 | 0.00 |
| Propane                        | 0.48               | 0.08     | 0.23 | 0.04 |
| Propylene                      | 6.28               | 0.04     | 0.81 | 0.00 |
| Benzene                        | 23.55              | 1.64     | 4.37 | 0.68 |
| Toluene                        | 21.29              | 0.20     | 2.08 | 0.00 |
| <u>Other</u>                   |                    |          |      |      |
| Nitrous Oxide                  | 2.18               | 0.33     | 1.31 | 0.30 |
| Nickel Carbonyl                | --                 | --       | --   | --   |

TABLE C-47. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test No. 223311 - Fuel No. 3, 15,000 Miles

|                                | Emissions in mg/km |          |          |      |
|--------------------------------|--------------------|----------|----------|------|
|                                | COLD-UDDS          | HOT-UDDS |          |      |
| Sulfates                       | 0.17               | 0.06     |          |      |
| Ammonia                        | 3.49               | 5.43     |          |      |
| Cyanides & Cyanogen            | 6.14               | 4.23     |          |      |
| Hydrogen Sulfide               | 0.00               | 0.00     |          |      |
| Sulfur Dioxide                 | 12.53              | 21.96    |          |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |          |      |
| Formaldehyde                   | 3.18               | 0.30     |          |      |
| Acetaldehyde                   | 0.73               | 0.65     |          |      |
| Acetone                        | 0.32               | 0.32     |          |      |
| Isobutyraldehyde               | 0.00               | 0.84     |          |      |
| Methyl ethyl ketone            | 0.33               | 0.11     |          |      |
| Crotonaldehyde                 | ----               | ----     |          |      |
| Hexanaldehyde                  | 0.31               | 0.03     |          |      |
| Benzaldehyde                   | ----               | ----     |          |      |
| <u>Organic Sulfides</u>        |                    |          |          |      |
| Carbonyl sulfide               | ----               | 0.00     |          |      |
| Methyl sulfide                 | ----               | 0.08     |          |      |
| Ethyl sulfide                  | ----               | 0.03     |          |      |
| Methyl disulfide               | ----               | 0.01     |          |      |
| <u>Organic Amines</u>          |                    |          |          |      |
| Monomethylamine                | 0.01               | 0.00     |          |      |
| Monoethylamine & dimethylamine | 0.00               | 0.03     |          |      |
| Trimethylamine                 | 0.00               | 0.00     |          |      |
| Diethylamine                   | 0.00               | 0.00     |          |      |
| Triethylamine                  | 0.00               | 0.00     |          |      |
| <u>Emissions in ppm</u>        |                    |          |          |      |
|                                | COLD-UDDS          |          | HOT-UDDS |      |
|                                | 1                  | 2        | 3        | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |          |      |
| Methane                        | 14.76              | 2.32     | 6.95     | 2.15 |
| Ethylene                       | 12.82              | 0.35     | 3.40     | 0.27 |
| Ethane                         | 1.98               | 0.65     | 1.41     | 0.57 |
| Acetylene                      | 8.61               | 0.00     | 0.10     | 0.00 |
| Propane                        | 0.29               | 0.03     | 0.28     | 0.05 |
| Propylene                      | 6.69               | 0.02     | 1.31     | 0.03 |
| Benzene                        | 8.45               | 0.17     | 2.55     | 0.25 |
| Toluene                        | 7.08               | 0.05     | 1.45     | 0.00 |
| <u>Other</u>                   |                    |          |          |      |
| Nitrous Oxide                  | 3.12               | 0.35     | 1.68     | 0.30 |
| Nickel Carbonyl                | 0.00               | 0.00     | 0.00     | 0.00 |

TABLE C-48. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test No. 223321 - Fuel No. 3, 15,000 Miles

|                                | Emissions in mg/km |          |
|--------------------------------|--------------------|----------|
|                                | COLD-UDDS          | HOT-UDDS |
| Sulfates                       | 0.10               | 0.01     |
| Ammonia                        | 0.92               | 1.23     |
| Cyanides & Cyanogen            | 7.02               | 4.81     |
| Hydrogen Sulfide               | 0.00               | 0.00     |
| Sulfur Dioxide                 | 26.27              | 22.47    |
| <u>Aldehydes &amp; Ketones</u> |                    |          |
| Formaldehyde                   | 1.63               | 0.00     |
| Acetaldehyde                   | 0.00               | 0.00     |
| Acetone                        | 0.00               | 0.00     |
| Isobutyraldehyde               | 1.99               | 2.99     |
| Methyl ethyl ketone            | 0.14               | 0.25     |
| Crotonaldehyde                 | ----               | ----     |
| Hexanaldehyde                  | 0.32               | 0.45     |
| Benzaldehyde                   | ----               | ----     |
| <u>Organic Sulfides</u>        |                    |          |
| Carbonyl sulfide               | 0.00               | 0.00     |
| Methyl sulfide                 | 0.00               | 0.03     |
| Ethyl sulfide                  | 0.00               | 0.00     |
| Methyl disulfide               | 0.00               | 0.00     |
| <u>Organic Amines</u>          |                    |          |
| Monomethylamine                | 0.01               | 0.00     |
| Monoethylamine & dimethylamine | 0.05               | 0.04     |
| Trimethylamine                 | 0.00               | 0.00     |
| Diethylamine                   | 0.00               | 0.00     |
| Triethylamine                  | 0.00               | 0.00     |

|                                | Emissions in ppm |      |          |      |
|--------------------------------|------------------|------|----------|------|
|                                | COLD-UDDS        |      | HOT-UDDS |      |
|                                | 1                | 2    | 3        | 4    |
| <u>Individual Hydrocarbons</u> |                  |      |          |      |
| Methane                        | 14.00            | 2.34 | 10.29    | 2.04 |
| Ethylene                       | 13.32            | 0.26 | 4.44     | 0.20 |
| Ethane                         | 2.26             | 0.56 | 1.48     | 0.45 |
| Acetylene                      | 7.06             | 0.00 | 2.82     | 0.00 |
| Propane                        | 0.23             | 0.02 | 0.20     | 0.00 |
| Propylene                      | 7.40             | 0.04 | 1.63     | 0.01 |
| Benzene                        | 5.54             | 0.21 | 1.60     | 0.04 |
| Toluene                        | 4.62             | 0.00 | 0.63     | 0.00 |
| <u>Other</u>                   |                  |      |          |      |
| Nitrous Oxide                  | 2.59             | 0.27 | 1.09     | 0.19 |
| Nickel Carbonyl                |                  |      |          |      |

TABLE C-49. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test 230111 - Fuel #1, Initial Mileage

|                                | Emissions in mg/km |          |
|--------------------------------|--------------------|----------|
|                                | COLD-UDDS          | HOT-UDDS |
| Sulfates                       | 0.03               | 0.01     |
| Ammonia                        | 63.02              | 105.65   |
| Cyanides & Cyanogen            | 1.54               | 1.13     |
| Hydrogen Sulfide               | 0.04               | 0.10     |
| Sulfur Dioxide                 | ----               | ----     |
| <u>Aldehydes &amp; Ketones</u> |                    |          |
| Formaldehyde                   | 0.00               | 0.07     |
| Acetaldehyde                   | 0.00               | 0.00     |
| Acetone                        | 0.00               | 0.00     |
| Isobutyraldehyde               | 0.00               | 0.00     |
| Methyl ethyl ketone            | 0.34               | 0.34     |
| Crotonaldehyde                 | --                 | --       |
| Hexanaldehyde                  | 0.00               | 0.00     |
| Benzaldehyde                   | --                 | --       |
| <u>Organic Sulfides</u>        |                    |          |
| Carbonyl sulfide               | 0.00               | 0.00     |
| Methyl sulfide                 | 0.00               | 0.00     |
| Ethyl sulfide                  | 0.00               | 0.47     |
| Methyl disulfide               | 0.00               | 0.00     |
| <u>Organic Amines</u>          |                    |          |
| Monomethylamine                | 0.00               | 0.02     |
| Monoethylamine & dimethylamine | 0.00               | 0.02     |
| Trimethylamine                 | 0.00               | 0.02     |
| Diethylamine                   | 0.00               | 0.00     |
| Triethylamine                  | 0.00               | 0.00     |

|                                | Emissions in ppm |      |          |      |
|--------------------------------|------------------|------|----------|------|
|                                | COLD-UDDS        |      | HOT-UDDS |      |
|                                | 1                | 2    | 3        | 4    |
| <u>Individual Hydrocarbons</u> |                  |      |          |      |
| Methane                        | 4.64             | 1.00 | 2.23     | 0.99 |
| Ethylene                       | 3.97             | 0.22 | 0.59     | 0.17 |
| Ethane                         | 0.56             | 0.00 | 0.17     | 0.00 |
| Acetylene                      | 0.89             | 0.03 | 0.03     | 0.22 |
| Propane                        | 0.00             | 0.00 | 0.00     | 0.00 |
| Propylene                      | 2.05             | 0.05 | 0.33     | 0.03 |
| Benzene                        | 3.72             | 0.03 | 1.21     | 0.00 |
| Toluene                        | 6.39             | 0.01 | 1.06     | 0.12 |
| <u>Other</u>                   |                  |      |          |      |
| Nitrous Oxide                  | 0.74             | 0.00 | 0.38     | 0.00 |
| Nickel Carbonyl                | 0.00             | 0.00 | 0.00     | 0.00 |



TABLE C-50. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test 230121 - Fuel #1, Initial Mileage

|                                | Emissions in mg/km |          |      |      |
|--------------------------------|--------------------|----------|------|------|
|                                | COLD-UDDS          | HOT-UDDS |      |      |
| Sulfates                       | 0.03               | 0.00     |      |      |
| Ammonia                        | 105.59             | 131.17   |      |      |
| Cyanides & Cyanogen            | 2.82               | 1.66     |      |      |
| Hydrogen Sulfide               | 0.03               | 0.16     |      |      |
| Sulfur Dioxide                 | ----               | ----     |      |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |      |      |
| Formaldehyde                   | 0.42               | 0.21     |      |      |
| Acetaldehyde                   | 1.07               | 1.10     |      |      |
| Acetone                        | 0.21               | 0.00     |      |      |
| Isobutyraldehyde               | 0.00               | 0.00     |      |      |
| Methyl ethyl ketone            | 0.00               | 0.32     |      |      |
| Crotonaldehyde                 | ----               | ----     |      |      |
| Hexanaldehyde                  | 0.00               | 0.00     |      |      |
| Benzaldehyde                   | ----               | ----     |      |      |
| <u>Organic Sulfides</u>        |                    |          |      |      |
| Carbonyl sulfide               | ----               | ----     |      |      |
| Methyl sulfide                 | ----               | ----     |      |      |
| Ethyl sulfide                  | ----               | ----     |      |      |
| Methyl disulfide               | ----               | ----     |      |      |
| <u>Organic Amines</u>          |                    |          |      |      |
| Monomethylamine                | 0.01               | 0.06     |      |      |
| Monoethylamine & dimethylamine | 0.00               | 0.02     |      |      |
| Trimethylamine                 | 0.00               | 0.00     |      |      |
| Diethylamine                   | 0.00               | 0.00     |      |      |
| Triethylamine                  | 0.00               | 0.00     |      |      |
| <u>Emissions in ppm</u>        |                    |          |      |      |
|                                | COLD-UDDS          | HOT-UDDS |      |      |
|                                | 1                  | 2        | 3    | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |      |      |
| Methane                        | 5.11               | 1.19     | 2.27 | 1.05 |
| Ethylene                       | 4.35               | 0.27     | 0.68 | 0.11 |
| Ethane                         | 0.86               | 0.11     | 0.37 | 0.11 |
| Acetylene                      | 1.25               | 0.01     | 0.01 | 0.00 |
| Propane                        | 0.09               | 0.00     | 0.04 | 0.00 |
| Propylene                      | 2.32               | 0.03     | 0.40 | 0.02 |
| Benzene                        | 4.54               | 0.34     | 1.78 | 0.27 |
| Toluene                        | 7.46               | 0.93     | 1.76 | 0.36 |
| <u>Other</u>                   |                    |          |      |      |
| Nitrous Oxide                  | 0.38               | 0.05     | 0.52 | 0.03 |
| Nickel Carbonyl                | 0.00               | 0.00     | 0.00 | 0.00 |

TABLE C-51. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test 230211 - Fuel #2, Initial Mileage

|                                | Emissions in mg/km |          |
|--------------------------------|--------------------|----------|
|                                | COLD-UDDS          | HOT-UDDS |
| Sulfates                       | 0.35               | 0.00     |
| Ammonia                        | 43.43              | 74.66    |
| Cyanides & Cyanogen            | 1.45               | 1.25     |
| Hydrogen Sulfide               | 0.00               | 0.00     |
| Sulfur Dioxide                 | ----               | ----     |
| <u>Aldehydes &amp; Ketones</u> |                    |          |
| Formaldehyde                   | 0.00               | 0.07     |
| Acetaldehyde                   | 0.00               | 0.00     |
| Acetone                        | 0.00               | 0.00     |
| Isobutyraldehyde               | 0.00               | 0.00     |
| Methyl ethyl ketone            | 0.38               | 0.00     |
| Crotonaldehyde                 | ----               | ----     |
| Hexanaldehyde                  | 0.59               | 0.00     |
| Benzaldehyde                   | ----               | ----     |
| <u>Organic Sulfides</u>        |                    |          |
| Carbonyl sulfide               | 0.06               | 0.03     |
| Methyl sulfide                 | 0.14               | 0.12     |
| Ethyl sulfide                  | 2.32               | 0.02     |
| Methyl disulfide               | 1.00               | 0.02     |
| <u>Organic Amines</u>          |                    |          |
| Monomethylamine                | 0.00               | 0.00     |
| Monoethylamine & dimethylamine | 0.00               | 0.00     |
| Trimethylamine                 | 0.00               | 0.00     |
| Diethylamine                   | 0.00               | 0.00     |
| Triethylamine                  | 0.00               | 0.00     |

|                                | Emissions in ppm |      |          |      |
|--------------------------------|------------------|------|----------|------|
|                                | COLD-UDDS        |      | HOT-UDDS |      |
|                                | 1                | 2    | 3        | 4    |
| <u>Individual Hydrocarbons</u> |                  |      |          |      |
| Methane                        | 3.13             | 0.00 | 0.85     | 0.00 |
| Ethylene                       | 3.44             | 0.18 | 0.60     | 0.12 |
| Ethane                         | 0.46             | 0.00 | 0.14     | 0.00 |
| Acetylene                      | 0.84             | 0.00 | 0.05     | 0.00 |
| Propane                        | 0.00             | 0.00 | 0.00     | 0.00 |
| Propylene                      | 1.78             | 0.10 | 0.34     | 0.05 |
| Benzene                        | 3.73             | 0.14 | 1.39     | 0.23 |
| Toluene                        | 5.80             | 0.00 | 1.28     | 0.03 |
| <u>Other</u>                   |                  |      |          |      |
| Nitrous Oxide                  | 0.63             | 0.04 | 1.11     | 0.05 |
| Nickel Carbonyl                | 0.00             | 0.00 | 0.00     | 0.00 |

TABLE C-52. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test 230221 - Fuel #2, Initial Mileage

|                                | Emissions in mg/km |          |      |      |
|--------------------------------|--------------------|----------|------|------|
|                                | COLD-UDDS          | HOT-UDDS |      |      |
| Sulfates                       | 0.46               | 0.11     |      |      |
| Ammonia                        | 62.89              | 74.87    |      |      |
| Cyanides & Cyanogen            | 3.00               | 1.92     |      |      |
| Hydrogen Sulfide               | 0.36               | 0.47     |      |      |
| Sulfur Dioxide                 | ----               | ----     |      |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |      |      |
| Formaldehyde                   | 0.13               | 0.28     |      |      |
| Acetaldehyde                   | 0.00               | 0.00     |      |      |
| Acetone                        | 0.00               | 0.00     |      |      |
| Isobutyraldehyde               | 0.00               | 0.00     |      |      |
| Methyl ethyl ketone            | 0.00               | 0.00     |      |      |
| Crotonaldehyde                 | ----               | ----     |      |      |
| Hexanaldehyde                  | 0.00               | 0.00     |      |      |
| Benzaldehyde                   | ----               | ----     |      |      |
| <u>Organic Sulfides</u>        |                    |          |      |      |
| Carbonyl sulfide               | 0.00               | 0.00     |      |      |
| Methyl sulfide                 | 0.00               | 0.00     |      |      |
| Ethyl sulfide                  | 1.01               | 0.00     |      |      |
| Methyl disulfide               | 0.40               | 0.00     |      |      |
| <u>Organic Amines</u>          |                    |          |      |      |
| Monomethylamine                | 0.00               | 0.00     |      |      |
| Monoethylamine & dimethylamine | 0.00               | 0.00     |      |      |
| Trimethylamine                 | 0.00               | 0.00     |      |      |
| Diethylamine                   | 0.00               | 0.00     |      |      |
| Triethylamine                  | 0.00               | 0.00     |      |      |
| <u>Emissions in ppm</u>        |                    |          |      |      |
|                                | COLD-UDDS          | HOT-UDDS |      |      |
|                                | 1                  | 2        | 3    | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |      |      |
| Methane                        | 4.25               | 0.49     | 2.15 | 1.19 |
| Ethylene                       | 3.17               | 0.08     | 0.69 | 0.20 |
| Ethane                         | 0.56               | 0.00     | 0.28 | 0.09 |
| Acetylene                      | 0.99               | 0.00     | 0.05 | 0.00 |
| Propane                        | 0.00               | 0.00     | 0.00 | 0.00 |
| Propylene                      | 1.64               | 0.00     | 0.38 | 0.10 |
| Benzene                        | 3.36               | 0.00     | 1.58 | 0.50 |
| Toluene                        | 5.17               | 0.12     | 1.58 | 0.29 |
| <u>Other</u>                   |                    |          |      |      |
| Nitrous Oxide                  | 0.38               | 0.05     | 1.53 | 0.12 |
| Nickel Carbonyl                | 0.00               | 0.00     | 0.00 | 0.00 |

TABLE C-53. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test 230311 - Fuel #3, Initial Mileage

|                                | Emissions in mg/km |          |      |      |
|--------------------------------|--------------------|----------|------|------|
|                                | COLD-UDDS          | HOT-UDDS |      |      |
| Sulfates                       | 0.15               | 0.00     |      |      |
| Ammonia                        | 62.31              | 57.32    |      |      |
| Cyanides & Cyanogen            | 2.67               | 2.99     |      |      |
| Hydrogen Sulfide               | 0.14               | 0.23     |      |      |
| Sulfur Dioxide                 | ----               | ----     |      |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |      |      |
| Formaldehyde                   | 0.00               | 0.00     |      |      |
| Acetaldehyde                   | 3.46               | 0.00     |      |      |
| Acetone                        | 0.00               | 0.00     |      |      |
| Isobutyraldehyde               | 0.00               | 0.00     |      |      |
| Methyl ethyl ketone            | 0.00               | 0.00     |      |      |
| Crotonaldehyde                 | ----               | ----     |      |      |
| Hexanaldehyde                  | 0.00               | 0.00     |      |      |
| Benzaldehyde                   | ----               | ----     |      |      |
| <u>Organic Sulfides</u>        |                    |          |      |      |
| Carbonyl sulfide               | 0.01               | 0.01     |      |      |
| Methyl sulfide                 | 0.01               | 0.06     |      |      |
| Ethyl sulfide                  | 0.40               | 0.00     |      |      |
| Methyl disulfide               | 0.22               | 0.01     |      |      |
| <u>Organic Amines</u>          |                    |          |      |      |
| Monomethylamine                | 0.00               | 0.00     |      |      |
| Monoethylamine & dimethylamine | 0.00               | 0.00     |      |      |
| Trimethylamine                 | 0.00               | 0.00     |      |      |
| Diethylamine                   | 0.00               | 0.00     |      |      |
| Triethylamine                  | 0.00               | 0.00     |      |      |
|                                | Emissions in ppm   |          |      |      |
|                                | COLD-UDDS          | HOT-UDDS |      |      |
|                                | 1                  | 2        | 3    | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |      |      |
| Methane                        | 4.92               | 1.09     | 2.11 | 1.16 |
| Ethylene                       | 4.23               | 0.19     | 0.57 | 0.18 |
| Ethane                         | 0.84               | 0.04     | 0.27 | 0.13 |
| Acetylene                      | 1.36               | 0.00     | 0.05 | 0.00 |
| Propane                        | 0.00               | 0.00     | 0.00 | 0.00 |
| Propylene                      | 2.50               | 0.10     | 0.20 | 0.05 |
| Benzene                        | 1.86               | 0.03     | 0.34 | 0.00 |
| Toluene                        | 1.57               | 0.00     | 0.12 | 0.00 |
| <u>Other</u>                   |                    |          |      |      |
| Nitrous Oxide                  | 0.61               | 0.10     | 1.05 | 0.13 |
| Nickel Carbonyl                | 0.00               | 0.00     | 0.00 | 0.00 |

TABLE C-54. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test 230321 - Fuel #3, Initial Mileage

|                                | Emissions in mg/km |          |      |      |
|--------------------------------|--------------------|----------|------|------|
|                                | COLD-UDDS          | HOT-UDDS |      |      |
| Sulfates                       | 0.34               | 0.00     |      |      |
| Ammonia                        | 49.99              | 56.00    |      |      |
| Cyanides & Cyanogen            | 3.18               | 2.37     |      |      |
| Hydrogen Sulfide               | 0.06               | 0.15     |      |      |
| Sulfur Dioxide                 | ----               | ----     |      |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |      |      |
| Formaldehyde                   | 0.00               | 0.00     |      |      |
| Acetaldehyde                   | 1.62               | 0.00     |      |      |
| Acetone                        | 0.00               | 0.00     |      |      |
| Isobutyraldehyde               | 0.62               | 0.00     |      |      |
| Methyl ethyl ketone            | 0.00               | 0.49     |      |      |
| Crotonaldehyde                 | ----               | ----     |      |      |
| Hexanaldehyde                  | 0.00               | 0.00     |      |      |
| Benzaldehyde                   | ----               | ----     |      |      |
| <u>Organic Sulfides</u>        |                    |          |      |      |
| Carbonyl sulfide               | 0.15               | 0.17     |      |      |
| Methyl sulfide                 | 0.00               | 0.02     |      |      |
| Ethyl sulfide                  | 0.25               | 0.00     |      |      |
| Methyl disulfide               | 0.50               | 0.00     |      |      |
| <u>Organic Amines</u>          |                    |          |      |      |
| Monomethylamine                | 0.00               | 0.00     |      |      |
| Monoethylamine & dimethylamine | 0.00               | 0.00     |      |      |
| Trimethylamine                 | 0.00               | 0.00     |      |      |
| Diethylamine                   | 0.00               | 0.00     |      |      |
| Triethylamine                  | 0.00               | 0.00     |      |      |
|                                | Emissions in ppm   |          |      |      |
|                                | COLD-UDDS          | HOT-UDDS |      |      |
|                                | 1                  | 2        | 3    | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |      |      |
| Methane                        | 5.00               | 0.47     | 1.92 | 0.64 |
| Ethylene                       | 4.00               | 0.14     | 0.48 | 0.13 |
| Ethane                         | 0.87               | 0.00     | 0.28 | 0.08 |
| Acetylene                      | 1.22               | 0.00     | 0.05 | 0.00 |
| Propane                        | 0.00               | 0.00     | 0.00 | 0.00 |
| Propylene                      | 2.40               | 0.10     | 0.32 | 0.05 |
| Benzene                        | 1.48               | 0.15     | 0.34 | 0.10 |
| Toluene                        | 1.28               | 0.00     | 0.12 | 0.00 |
| <u>Other</u>                   |                    |          |      |      |
| Nitrous Oxide                  | 0.56               | 0.06     | 0.41 | 0.06 |
| Nickel Carbonyl                | 0.00               | 0.00     | 0.00 | 0.00 |

TABLE C-55. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS

Test 231111 - Fuel #1, 5000 Miles

|                                | Emissions in mg/km |          |
|--------------------------------|--------------------|----------|
|                                | COLD-UDDS          | HOT-UDDS |
| Sulfates                       | 0.21               | 0.03     |
| Ammonia                        | 3.86               | 4.45     |
| Cyanides & Cyanogen            | 0.92               | 1.17     |
| Hydrogen Sulfide               | 0.00               | 0.00     |
| Sulfur Dioxide                 | ----               | ----     |
| <u>Aldehydes &amp; Ketones</u> |                    |          |
| Formaldehyde                   | 0.03               | 0.00     |
| Acetaldehyde                   | 0.00               | 0.00     |
| Acetone                        | 0.00               | 0.00     |
| Isobutyraldehyde               | 0.01               | 1.16     |
| Methyl ethyl ketone            | 0.00               | 0.00     |
| Crotonaldehyde                 | ----               | ----     |
| Hexanaldehyde                  | 0.00               | 0.00     |
| Benzaldehyde                   | ----               | ----     |
| <u>Organic Sulfides</u>        |                    |          |
| Carbonyl sulfide               | 0.06               | 0.02     |
| Methyl sulfide                 | 0.02               | 0.01     |
| Ethyl sulfide                  | 0.04               | 0.00     |
| Methyl disulfide               | 0.01               | 0.00     |
| <u>Organic Amines</u>          |                    |          |
| Monomethylamine                | 0.01               | 0.01     |
| Monoethylamine & dimethylamine | 0.01               | 0.02     |
| Trimethylamine                 | 0.00               | 0.00     |
| Diethylamine                   | 0.00               | 0.00     |
| Triethylamine                  | 0.00               | 0.00     |

|                                | Emissions in ppm |      |          |      |
|--------------------------------|------------------|------|----------|------|
|                                | COLD-UDDS        |      | HOT-UDDS |      |
|                                | 1                | 2    | 3        | 4    |
| <u>Individual Hydrocarbons</u> |                  |      |          |      |
| Methane                        | 4.76             | 0.04 | 1.42     | 0.52 |
| Ethylene                       | 4.61             | 0.10 | 0.35     | 0.08 |
| Ethane                         | 0.88             | 0.03 | 0.24     | 0.07 |
| Acetylene                      | 1.60             | 0.01 | 0.05     | 0.00 |
| Propane                        | 0.00             | 0.00 | 0.00     | 0.08 |
| Propylene                      | 2.35             | 0.00 | 0.22     | 0.03 |
| Benzene                        | 4.59             | 0.01 | 0.59     | 0.04 |
| Toluene                        | 7.68             | 0.05 | 0.25     | 0.05 |
| <u>Other</u>                   |                  |      |          |      |
| Nitrous Oxide                  | 0.78             | 0.08 | 1.41     | 0.11 |
| Nickel Carbonyl                | 0.00             | 0.00 | 0.00     | 0.00 |

TABLE C-56. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS

Test 231121 - Fuel #1, 5000 Miles

|                                 | Emissions in mg/km |          |      |      |
|---------------------------------|--------------------|----------|------|------|
|                                 | COLD-UDDS          | HOT-UDDS |      |      |
| Sulfates                        | 0.17               | 0.04     |      |      |
| Ammonia                         | 5.03               | 4.39     |      |      |
| Cyanides & Cyanogen             | 2.13               | 0.99     |      |      |
| Hydrogen Sulfide                | 0.00               | 0.00     |      |      |
| Sulfur Dioxide                  | ----               | ----     |      |      |
| <u>Aldehydes &amp; Ketones</u>  |                    |          |      |      |
| Formaldehyde                    | 0.98               | 0.10     |      |      |
| Acetaldehyde                    | 0.00               | 0.00     |      |      |
| Acetone                         | 0.00               | 0.00     |      |      |
| Isobutyraldehyde                | 9.57               | 0.43     |      |      |
| Methyl ethyl ketone             | 0.00               | 0.00     |      |      |
| Crotonaldehyde                  | ----               | ----     |      |      |
| Hexanaldehyde                   | 0.14               | 0.00     |      |      |
| Benzaldehyde                    | ----               | ----     |      |      |
| <u>Organic Sulfides</u>         |                    |          |      |      |
| Carbonyl sulfide                | 0.00               | 0.07     |      |      |
| Methyl sulfide                  | 0.02               | 0.02     |      |      |
| Ethyl sulfide                   | 0.00               | 0.00     |      |      |
| Methyl disulfide                | 0.00               | 0.00     |      |      |
| <u>Organic Amines</u>           |                    |          |      |      |
| Monomethylamine                 | 0.00               | 0.00     |      |      |
| Monocethylamine & dimethylamine | 0.00               | 0.00     |      |      |
| Trimethylamine                  | 0.00               | 0.00     |      |      |
| Diethylamine                    | 0.00               | 0.00     |      |      |
| Triethylamine                   | 0.00               | 0.00     |      |      |
|                                 | Emissions in ppm   |          |      |      |
|                                 | COLD-UDDS          | HOT-UDDS |      |      |
|                                 | 1                  | 2        | 3    | 4    |
| <u>Individual Hydrocarbons</u>  |                    |          |      |      |
| Methane                         | 4.47               | 0.00     | 0.97 | 0.00 |
| Ethylene                        | 4.23               | 0.14     | 0.37 | 0.11 |
| Ethane                          | 0.53               | 0.00     | 0.03 | 0.00 |
| Acetylene                       | 1.41               | 0.01     | 0.06 | 0.01 |
| Propane                         | 0.00               | 0.00     | 0.00 | 0.00 |
| Propylene                       | 2.31               | 0.09     | 0.25 | 0.05 |
| Benzene                         | 4.27               | 0.00     | 0.32 | 0.00 |
| Toluene                         | 7.24               | 0.00     | 0.00 | 0.00 |
| <u>Other</u>                    |                    |          |      |      |
| Nitrous Oxide                   | 0.48               | 0.07     | 0.71 | 0.28 |
| Nickel Carbonyl                 | 0.00               | 0.00     | 0.00 | 0.00 |



TABLE C-57. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test No. 231211 - Fuel No. 2, 5000 Miles

|                                | Emissions in mg/km |          |          |      |
|--------------------------------|--------------------|----------|----------|------|
|                                | COLD-UDDS          | HOT-UDDS |          |      |
| Sulfates                       | 1.02               | 0.17     |          |      |
| Ammonia                        | 5.76               | 3.79     |          |      |
| Cyanides & Cyanogen            | 2.04               | 0.76     |          |      |
| Hydrogen Sulfide               | 0.08               | 0.11     |          |      |
| Sulfur Dioxide                 | ----               | ----     |          |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |          |      |
| Formaldehyde                   | 0.96               | 0.54     |          |      |
| Acetaldehyde                   | 0.44               | 0.37     |          |      |
| Acetone                        | 0.00               | 0.00     |          |      |
| Isobutyraldehyde               | 0.17               | 0.82     |          |      |
| Methyl ethyl ketone            | 0.00               | 0.00     |          |      |
| Crotonaldehyde                 | ----               | ----     |          |      |
| Hexanaldehyde                  | 0.00               | 0.00     |          |      |
| Benzaldehyde                   | ----               | ----     |          |      |
| <u>Organic Sulfides</u>        |                    |          |          |      |
| Carbonyl sulfide               | 0.23               | 0.09     |          |      |
| Methyl sulfide                 | 0.01               | 0.10     |          |      |
| Ethyl sulfide                  | 0.04               | 0.00     |          |      |
| Methyl disulfide               | 0.02               | 0.01     |          |      |
| <u>Organic Amines</u>          |                    |          |          |      |
| Monomethylamine                | 0.01               | 0.02     |          |      |
| Monoethylamine & dimethylamine | 0.03               | 0.02     |          |      |
| Trimethylamine                 | 0.00               | 0.00     |          |      |
| Diethylamine                   | 0.00               | 0.00     |          |      |
| Triethylamine                  | 0.00               | 0.00     |          |      |
| Emissions in ppm               |                    |          |          |      |
|                                | COLD-UDDS          |          | HOT-UDDS |      |
|                                | 1                  | 2        | 3        | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |          |      |
| Methane                        | 4.73               | 0.50     | 1.48     | 0.37 |
| Ethylene                       | 4.14               | 0.08     | 0.38     | 0.11 |
| Ethane                         | 3.90               | 0.00     | 0.15     | 0.00 |
| Acetylene                      | 1.42               | 0.01     | 0.01     | 0.00 |
| Propane                        | 0.00               | 0.00     | 0.00     | 0.00 |
| Propylene                      | 2.16               | 0.00     | 0.19     | 0.01 |
| Benzene                        | 3.93               | 0.00     | 0.30     | 0.00 |
| Toluene                        | 4.53               | 0.00     | 0.26     | 0.00 |
| <u>Other</u>                   |                    |          |          |      |
| Nitrous Oxide                  | ----               | 0.09     | 0.72     | 0.17 |
| Nickel Carbonyl                | 0.00               | 0.00     | 0.00     | 0.00 |

TABLE C-58. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test No. 231221 - Fuel No. 2, 5000 Miles

|                                | Emissions in mg/km |          |
|--------------------------------|--------------------|----------|
|                                | COLD-UDDS          | HOT-UDDS |
| Sulfates                       | 0.19               | 0.05     |
| Ammonia                        | 5.42               | 2.18     |
| Cyanides & Cyanogen            | 1.35               | 0.99     |
| Hydrogen Sulfide               | 0.00               | 0.00     |
| Sulfur Dioxide                 | ----               | ----     |
| <u>Aldehydes &amp; Ketones</u> |                    |          |
| Formaldehyde                   | 0.55               | 0.42     |
| Acetaldehyde                   | 0.30               | 0.40     |
| Acetone                        | 0.00               | 0.00     |
| Isobutyraldehyde               | 0.65               | 1.42     |
| Methyl ethyl ketone            | 0.00               | 0.00     |
| Crotonaldehyde                 | ----               | ----     |
| Hexanaldehyde                  | 0.00               | 0.00     |
| Benzaldehyde                   | ----               | ----     |
| <u>Organic Sulfides</u>        |                    |          |
| Carbonyl sulfide               | 0.01               | 0.05     |
| Methyl sulfide                 | 0.00               | 0.04     |
| Ethyl sulfide                  | 0.36               | 0.05     |
| Methyl disulfide               | 0.02               | 0.00     |
| <u>Organic Amines</u>          |                    |          |
| Monomethylamine                |                    |          |
| Monoethylamine & dimethylamine |                    |          |
| Trimethylamine                 |                    |          |
| Diethylamine                   |                    |          |
| Triethylamine                  |                    |          |

|                                | Emissions in ppm |      |          |      |
|--------------------------------|------------------|------|----------|------|
|                                | COLD-UDDS        |      | HOT-UDDS |      |
|                                | 1                | 2    | 3        | 4    |
| <u>Individual Hydrocarbons</u> |                  |      |          |      |
| Methane                        | 4.62             | 0.33 | 1.52     | 0.74 |
| Ethylene                       | 4.55             | 0.10 | 0.51     | 0.10 |
| Ethane                         | 0.86             | 0.03 | 0.22     | 0.06 |
| Acetylene                      | 1.54             | 0.05 | 0.10     | 0.01 |
| Propane                        | 0.09             | 0.07 | 0.02     | 0.00 |
| Propylene                      | 2.44             | 0.05 | 0.31     | 0.04 |
| Benzene                        | 5.08             | 0.24 | 0.69     | 0.01 |
| Toluene                        | 8.30             | 0.50 | 0.96     | 0.09 |
| <u>Other</u>                   |                  |      |          |      |
| Nitrous Oxide                  | 0.58             | 0.16 | 1.66     | 0.51 |
| Nickel Carbonyl                | 0.00             | 0.00 | 0.00     | 0.00 |

TABLE C-59. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS

Test 231311 - Fuel No. 3, 5000 Miles

|                                | Emissions in mg/km |          |
|--------------------------------|--------------------|----------|
|                                | COLD-UDDS          | HOT-UDDS |
| Sulfates                       | 0.29               | 0.03     |
| Ammonia                        | 0.62               | 0.64     |
| Cyanides & Cyanogen            | 0.95               | 1.39     |
| Hydrogen Sulfide               | 0.00               | 0.00     |
| Sulfur Dioxide                 | ----               | ----     |
| <u>Aldehydes &amp; Ketones</u> |                    |          |
| Formaldehyde                   | 0.07               | 0.00     |
| Acetaldehyde                   | 0.00               | 0.00     |
| Acetone                        | 0.00               | 0.00     |
| Isobutyraldehyde               | 0.00               | 0.31     |
| Methyl ethyl ketone            | 0.00               | 0.00     |
| Crotonaldehyde                 | ----               | ----     |
| Hexanaldehyde                  | 0.00               | 0.00     |
| Benzaldehyde                   | ----               | ----     |
| <u>Organic Sulfides</u>        |                    |          |
| Carbonyl sulfide               | 0.00               | 0.05     |
| Methyl sulfide                 | 0.07               | 0.12     |
| Ethyl sulfide                  | 0.12               | 0.02     |
| Methyl disulfide               | 0.02               | 0.00     |
| <u>Organic Amines</u>          |                    |          |
| Monomethylamine                | 0.03               | 0.04     |
| Monoethylamine & dimethylamine | 0.00               | 0.05     |
| Trimethylamine                 | 0.00               | 0.00     |
| Diethylamine                   | 0.00               | 0.00     |
| Triethylamine                  | 0.00               | 0.00     |

|                                | Emissions in ppm |      |          |      |
|--------------------------------|------------------|------|----------|------|
|                                | COLD-UDDS        |      | HOT-UDDS |      |
|                                | 1                | 2    | 3        | 4    |
| <u>Individual Hydrocarbons</u> |                  |      |          |      |
| Methane                        | 4.35             | 0.65 | 1.67     | 0.40 |
| Ethylene                       | 3.55             | 0.26 | 0.44     | 0.17 |
| Ethane                         | 0.70             | 0.03 | 0.21     | 0.07 |
| Acetylene                      | 1.27             | 0.03 | 0.03     | 0.00 |
| Propane                        | 0.00             | 0.00 | 0.00     | 0.14 |
| Propylene                      | 2.18             | 0.02 | 0.28     | 0.03 |
| Benzene                        | 1.37             | 0.00 | 0.20     | 0.00 |
| Toluene                        | 1.43             | 0.05 | 0.10     | 0.00 |
| <u>Other</u>                   |                  |      |          |      |
| Nitrous Oxide                  | 0.74             | 0.06 | 0.73     | 0.13 |
| Nickel Carbonyl                | 0.00             | 0.00 | 0.00     | 0.00 |

TABLE C-60. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS

Test 231321 - Fuel No. 3, 5000 Miles

|                                | Emissions in mg/km |          |      |      |
|--------------------------------|--------------------|----------|------|------|
|                                | COLD-UDDS          | HOT-UDDS |      |      |
| Sulfates                       | 0.32               | 0.09     |      |      |
| Ammonia                        | 1.37               | 2.31     |      |      |
| Cyanides & Cyanogen            | 2.48               | 0.49     |      |      |
| Hydrogen Sulfide               | 0.00               | 0.00     |      |      |
| Sulfur Dioxide                 | ----               | ----     |      |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |      |      |
| Formaldehyde                   | 0.65               | 0.31     |      |      |
| Acetaldehyde                   | 0.15               | 0.00     |      |      |
| Acetone                        | 0.00               | 0.00     |      |      |
| Isobutyraldehyde               | 0.00               | 0.14     |      |      |
| Methyl ethyl ketone            | 0.00               | 0.00     |      |      |
| Crotonaldehyde                 | ----               | ----     |      |      |
| Hexanaldehyde                  | 0.00               | 0.00     |      |      |
| Benzaldehyde                   | ----               | ----     |      |      |
| <u>Organic Sulfides</u>        |                    |          |      |      |
| Carbonyl sulfide               | 0.03               | 0.01     |      |      |
| Methyl sulfide                 | 0.01               | 0.01     |      |      |
| Ethyl sulfide                  | 0.07               | 0.00     |      |      |
| Methyl disulfide               | 0.02               | 0.00     |      |      |
| <u>Organic Amines</u>          |                    |          |      |      |
| Monomethylamine                | 0.00               | 0.10     |      |      |
| Monoethylamine & dimethylamine | 0.00               | 0.10     |      |      |
| Trimethylamine                 | 0.00               | 0.08     |      |      |
| Diethylamine                   | 0.00               | 0.00     |      |      |
| Triethylamine                  | 0.00               | 0.00     |      |      |
|                                | Emissions in ppm   |          |      |      |
|                                | COLD-UDDS          | HOT-UDDS |      |      |
|                                | 1                  | 2        | 3    | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |      |      |
| Methane                        | 5.34               | 0.91     | 1.84 | 0.86 |
| Ethylene                       | 4.51               | 0.25     | 0.46 | 0.16 |
| Ethane                         | 0.91               | 0.08     | 0.29 | 0.10 |
| Acetylene                      | 1.67               | 0.08     | 0.03 | 0.00 |
| Propane                        | 0.02               | 0.00     | 0.05 | 0.05 |
| Propylene                      | 2.50               | 0.09     | 0.22 | 0.04 |
| Benzene                        | 1.71               | 0.05     | 0.12 | 0.05 |
| Toluene                        | 1.85               | 0.05     | 0.10 | 0.00 |
| <u>Other</u>                   |                    |          |      |      |
| Nitrous Oxide                  | 0.69               | 0.07     | 0.69 | 0.14 |
| Nickel Carbonyl                | 0.00               | 0.00     | 0.00 | 0.00 |

TABLE C-61. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS

Test 232111 - Fuel No. 1, 10,000 Miles

|                                | Emissions in mg/km |          |          |      |
|--------------------------------|--------------------|----------|----------|------|
|                                | COLD-UDDS          | HOT-UDDS |          |      |
| Sulfates                       | 0.27               | 0.02     |          |      |
| Ammonia                        | 6.26               | 7.34     |          |      |
| Cyanides & Cyanogen            | 2.13               | 1.19     |          |      |
| Hydrogen Sulfide               | 0.00               | 0.00     |          |      |
| Sulfur Dioxide                 | 15.45              | 4.94     |          |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |          |      |
| Formaldehyde                   | 0.28               | 0.06     |          |      |
| Acetaldehyde                   | 0.88               | 0.00     |          |      |
| Acetone                        | 0.00               | 0.00     |          |      |
| Isobutyraldehyde               | 1.79               | 3.88     |          |      |
| Methyl ethyl ketone            | 0.00               | 0.00     |          |      |
| Crotonaldehyde                 | ----               | ----     |          |      |
| Hexanaldehyde                  | 0.00               | 0.00     |          |      |
| Benzaldehyde                   | ----               | ----     |          |      |
| <u>Organic Sulfides</u>        |                    |          |          |      |
| Carbonyl sulfide               | 0.06               | 0.00     |          |      |
| Methyl sulfide                 | 0.01               | 0.06     |          |      |
| Ethyl sulfide                  | 0.42               | 0.06     |          |      |
| Methyl disulfide               | 0.02               | 0.03     |          |      |
| <u>Organic Amines</u>          |                    |          |          |      |
| Monomethylamine                | 0.06               | 0.00     |          |      |
| Monoethylamine & dimethylamine | 0.05               | 0.00     |          |      |
| Trimethylamine                 | 0.00               | 0.00     |          |      |
| Diethylamine                   | 0.00               | 0.00     |          |      |
| Triethylamine                  | 0.00               | 0.00     |          |      |
| <br><u>Emissions in ppm</u>    |                    |          |          |      |
|                                | COLD-UDDS          |          | HOT-UDDS |      |
|                                | 1                  | 2        | 3        | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |          |      |
| Methane                        | 5.95               | 0.54     | 1.63     | 0.51 |
| Ethylene                       | 5.30               | 0.10     | 0.43     | 0.03 |
| Ethane                         | 0.99               | 0.11     | 0.25     | 0.15 |
| Acetylene                      | 1.42               | 0.00     | 0.00     | 0.00 |
| Propane                        | 0.00               | 0.00     | 0.00     | 0.22 |
| Propylene                      | 2.76               | 0.00     | 0.25     | 0.00 |
| Benzene                        | 4.81               | 0.20     | 0.62     | 0.12 |
| Toluene                        | 7.28               | 0.08     | 0.29     | 0.00 |
| <u>Other</u>                   |                    |          |          |      |
| Nitrous Oxide                  | 0.59               | 0.15     | 0.96     | 0.20 |
| Nickel Carbonyl                | 0.00               | 0.00     | 0.00     | 0.00 |

TABLE C-62. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test 232121 - Fuel No. 1, 10,000 Miles

|                                | Emissions in mg/km |          |      |      |
|--------------------------------|--------------------|----------|------|------|
|                                | COLD-UDDS          | HOT-UDDS |      |      |
| Sulfates                       | 0.01               | 0.04     |      |      |
| Ammonia                        | 7.01               | 4.16     |      |      |
| Cyanides & Cyanogen            | 2.62               | 0.99     |      |      |
| Hydrogen Sulfide               | 0.00               | 0.00     |      |      |
| Sulfur Dioxide                 | 10.88              | 3.75     |      |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |      |      |
| Formaldehyde                   | 0.00               | 0.00     |      |      |
| Acetaldehyde                   | 0.59               | 0.49     |      |      |
| Acetone                        | 0.00               | 0.00     |      |      |
| Isobutyraldehyde               | 0.00               | 0.00     |      |      |
| Methyl ethyl ketone            | 0.00               | 0.00     |      |      |
| Crotonaldehyde                 | ----               | ----     |      |      |
| Hexanaldehyde                  | 0.39               | 0.58     |      |      |
| Benzaldehyde                   | ----               | ----     |      |      |
| <u>Organic Sulfides</u>        |                    |          |      |      |
| Carbonyl sulfide               | 0.00               | 0.00     |      |      |
| Methyl sulfide                 | 0.00               | 0.00     |      |      |
| Ethyl sulfide                  | 0.00               | 0.00     |      |      |
| Methyl disulfide               | 0.00               | 0.00     |      |      |
| <u>Organic Amines</u>          |                    |          |      |      |
| Monomethylamine                | 0.03               | 0.03     |      |      |
| Monoethylamine & dimethylamine | 0.00               | 0.05     |      |      |
| Trimethylamine                 | 0.00               | 0.00     |      |      |
| Diethylamine                   | 0.00               | 0.00     |      |      |
| Triethylamine                  | 0.00               | 0.00     |      |      |
| <u>Emissions in ppm</u>        |                    |          |      |      |
|                                | COLD-UDDS          | HOT-UDDS |      |      |
|                                | 1                  | 2        | 3    | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |      |      |
| Methane                        | 6.65               | 0.60     | 1.54 | 0.51 |
| Ethylene                       | 6.02               | 0.08     | 0.44 | 0.03 |
| Ethane                         | 0.99               | 0.00     | 0.19 | 0.03 |
| Acetylene                      | 1.69               | 0.00     | 0.02 | 0.00 |
| Propane                        | 0.00               | 0.00     | 0.00 | 0.00 |
| Propylene                      | 2.98               | 0.00     | 0.21 | 0.00 |
| Benzene                        | 6.67               | 0.05     | 0.84 | 0.03 |
| Toluene                        | 11.27              | 0.10     | 0.65 | 0.08 |
| <u>Other</u>                   |                    |          |      |      |
| Nitrous Oxide                  | 0.47               | 0.12     | 1.17 | 0.13 |
| Nickel Carbonyl                | 0.00               | 0.00     | 0.00 | 0.00 |

TABLE C-63. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS

Test 232211 - Fuel No. 2, 10,000 Miles

|                                | Emissions in mg/km |          |
|--------------------------------|--------------------|----------|
|                                | COLD-UDDS          | HOT-UDDS |
| Sulfates                       | 0.10               | 0.01     |
| Ammonia                        | 3.21               | 4.82     |
| Cyanides & Cyanogen            | 1.93               | 1.40     |
| Hydrogen Sulfide               | 0.00               | 0.00     |
| Sulfur Dioxide                 | 25.31              | 24.71    |
| <u>Aldehydes &amp; Ketones</u> |                    |          |
| Formaldehyde                   | 0.00               | 0.00     |
| Acetaldehyde                   | 0.03               | 0.06     |
| Acetone                        | 0.00               | 0.00     |
| Isobutyraldehyde               | 3.26               | 7.91     |
| Methyl ethyl ketone            | 0.00               | 0.00     |
| Crotonaldehyde                 | ----               | ----     |
| Hexanaldehyde                  | 0.00               | 0.00     |
| Benzaldehyde                   | ----               | ----     |
| <u>Organic Sulfides</u>        |                    |          |
| Carbonyl sulfide               | 0.17               | 0.00     |
| Methyl sulfide                 | 0.00               | 0.00     |
| Ethyl sulfide                  | 0.00               | 0.00     |
| Methyl disulfide               | 0.00               | 0.00     |
| <u>Organic Amines</u>          |                    |          |
| Monomethylamine                | 0.00               | 0.00     |
| Monoethylamine & dimethylamine | 0.00               | 0.01     |
| Trimethylamine                 | 0.00               | 0.00     |
| Diethylamine                   | 0.00               | 0.00     |
| Triethylamine                  | 0.00               | 0.00     |

|                                | Emissions in ppm |      |          |      |
|--------------------------------|------------------|------|----------|------|
|                                | COLD-UDDS        |      | HOT-UDDS |      |
|                                | 1                | 2    | 3        | 4    |
| <u>Individual Hydrocarbons</u> |                  |      |          |      |
| Methane                        | 5.30             | 0.67 | 1.96     | 0.60 |
| Ethylene                       | 4.89             | 0.10 | 0.36     | 0.03 |
| Ethane                         | 0.82             | 0.03 | 0.23     | 0.07 |
| Acetylene                      | 1.39             | 0.00 | 0.01     | 0.00 |
| Propane                        | 0.00             | 0.00 | 0.00     | 0.00 |
| Propylene                      | 2.58             | 0.00 | 0.20     | 0.00 |
| Benzene                        | 5.84             | 0.06 | 0.69     | 0.02 |
| Toluene                        | 9.77             | 0.10 | 0.59     | 0.08 |
| <u>Other</u>                   |                  |      |          |      |
| Nitrous Oxide                  | 0.64             | 0.17 | 1.56     | 0.20 |
| Nickel Carbonyl                | 0.00             | 0.00 | 0.00     | 0.00 |



TABLE C-64. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS

Test 232221 - Fuel No. 2, 10,000 Miles

|                                | Emissions in mg/km |          |      |      |
|--------------------------------|--------------------|----------|------|------|
|                                | COLD-UDDS          | HOT-UDDS |      |      |
| Sulfates                       | 0.20               | 0.03     |      |      |
| Ammonia                        | 2.41               | 2.64     |      |      |
| Cyanides & Cyanogen            | 2.36               | 1.18     |      |      |
| Hydrogen Sulfide               | 0.00               | 0.00     |      |      |
| Sulfur Dioxide                 | 54.55              | 24.10    |      |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |      |      |
| Formaldehyde                   | 0.17               | 0.00     |      |      |
| Acetaldehyde                   | 0.16               | 0.00     |      |      |
| Acetone                        | 0.98               | 1.95     |      |      |
| Isobutyraldehyde               | 0.00               | 0.00     |      |      |
| Methyl ethyl ketone            | 0.00               | 0.00     |      |      |
| Crotonaldehyde                 | ----               | ----     |      |      |
| Hexanaldehyde                  | 0.00               | 0.00     |      |      |
| Benzaldehyde                   | ----               | ----     |      |      |
| <u>Organic Sulfides</u>        |                    |          |      |      |
| Carbonyl sulfide               | 0.08               | 0.00     |      |      |
| Methyl sulfide                 | 0.01               | 0.00     |      |      |
| Ethyl sulfide                  | 0.04               | 0.00     |      |      |
| Methyl disulfide               | 0.00               | 0.00     |      |      |
| <u>Organic Amines</u>          |                    |          |      |      |
| Monomethylamine                | 0.00               | 0.02     |      |      |
| Monoethylamine & dimethylamine | 0.03               | 0.01     |      |      |
| Trimethylamine                 | 0.00               | 0.00     |      |      |
| Diethylamine                   | 0.00               | 0.00     |      |      |
| Triethylamine                  | 0.00               | 0.00     |      |      |
| <u>Emissions in ppm</u>        |                    |          |      |      |
|                                | COLD-UDDS          | HOT-UDDS |      |      |
|                                | 1                  | 2        | 3    | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |      |      |
| Methane                        | 7.63               | 0.72     | 2.10 | 0.65 |
| Ethylene                       | 7.20               | 0.07     | 0.44 | 0.08 |
| Ethane                         | 1.26               | 0.10     | 0.30 | 0.10 |
| Acetylene                      | 2.50               | 0.00     | 0.01 | 0.00 |
| Propane                        | 0.00               | 0.00     | 0.00 | 0.00 |
| Propylene                      | 3.47               | 0.00     | 0.25 | 0.00 |
| Benzene                        | 8.30               | 0.05     | 0.69 | 0.05 |
| Toluene                        | 14.39              | 0.15     | 0.77 | 0.08 |
| <u>Other</u>                   |                    |          |      |      |
| Nitrous Oxide                  | 0.70               | 0.13     | 1.27 | 0.20 |
| Nickel Carbonyl                | 0.00               | 0.00     | 0.00 | 0.00 |

TABLE C-65. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test 232311 - Fuel No. 3, 10,000 Miles

|                                | Emissions in mg/km |          |
|--------------------------------|--------------------|----------|
|                                | COLD-UDDS          | HOT-UDDS |
| Sulfates                       | 0.17               | 0.04     |
| Ammonia                        | 9.88               | 10.07    |
| Cyanides & Cyanogen            | 2.70               | 1.28     |
| Hydrogen Sulfide               | 0.00               | 0.00     |
| Sulfur Dioxide                 | 25.12              | 21.64    |
| <u>Aldehydes &amp; Ketones</u> |                    |          |
| Formaldehyde                   | 0.00               | 0.00     |
| Acetaldehyde                   | 0.24               | 0.27     |
| Acetone                        | 0.00               | 0.00     |
| Isobutyraldehyde               | 1.19               | 0.40     |
| Methyl ethyl ketone            | 0.00               | 0.00     |
| Crotonaldehyde                 | ----               | ----     |
| Hexanaldehyde                  | 0.00               | 0.00     |
| Benzaldehyde                   | ----               | ----     |
| <u>Organic Sulfides</u>        |                    |          |
| Carbonyl sulfide               | 0.00               | 0.00     |
| Methyl sulfide                 | 0.02               | 0.00     |
| Ethyl sulfide                  | 0.00               | 0.00     |
| Methyl disulfide               | 0.00               | 0.00     |
| <u>Organic Amines</u>          |                    |          |
| Monomethylamine                | 0.02               | 0.03     |
| Monoethylamine & dimethylamine | 0.00               | 0.02     |
| Trimethylamine                 | 0.00               | 0.00     |
| Diethylamine                   | 0.00               | 0.00     |
| Triethylamine                  | 0.00               | 0.00     |

|                                | Emissions in ppm |      |          |      |
|--------------------------------|------------------|------|----------|------|
|                                | COLD-UDDS        |      | HOT-UDDS |      |
|                                | 1                | 2    | 3        | 4    |
| <u>Individual Hydrocarbons</u> |                  |      |          |      |
| Methane                        | 5.11             | 0.79 | 2.12     | 0.82 |
| Ethylene                       | 4.36             | 0.03 | 0.43     | 0.02 |
| Ethane                         | 0.96             | 0.01 | 0.33     | 0.02 |
| Acetylene                      | 1.44             | 0.00 | 0.01     | 0.00 |
| Propane                        | 0.00             | 0.00 | 0.00     | 0.00 |
| Propylene                      | 2.56             | 0.01 | 0.26     | 0.02 |
| Benzene                        | 2.05             | 0.02 | 0.16     | 0.00 |
| Toluene                        | 3.82             | 0.00 | 0.00     | 0.00 |
| <u>Other</u>                   |                  |      |          |      |
| Nitrous Oxide                  | 0.74             | 0.10 | 1.12     | 0.16 |
| Nickel Carbonyl                | 0.00             | 0.00 | 0.00     | 0.00 |

TABLE C-66. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test 232321 - Fuel No. 3, 10,000 Miles

|                                | Emissions in mg/km |          |
|--------------------------------|--------------------|----------|
|                                | COLD-UDDS          | HOT-UDDS |
| Sulfates                       | 0.12               | 0.06     |
| Ammonia                        | 7.61               | 11.01    |
| Cyanides & Cyanogen            | 1.57               | 1.20     |
| Hydrogen Sulfide               | 0.00               | 0.00     |
| Sulfur Dioxide                 | 11.04              | 15.88    |
| <u>Aldehydes &amp; Ketones</u> |                    |          |
| Formaldehyde                   | 0.00               | 0.00     |
| Acetaldehyde                   | 0.28               | 0.32     |
| Acetone                        | 0.00               | 0.00     |
| Isobutyraldehyde               | 0.00               | 4.04     |
| Methyl ethyl ketone            | 0.00               | 0.00     |
| Crotonaldehyde                 | ----               | ----     |
| Hexanaldehyde                  | 0.00               | 0.00     |
| Benzaldehyde                   | ----               | ----     |
| <u>Organic Sulfides</u>        |                    |          |
| Carbonyl sulfide               | 0.00               | 0.00     |
| Methyl sulfide                 | 0.00               | 0.00     |
| Ethyl sulfide                  | 0.00               | 0.00     |
| Methyl disulfide               | 0.00               | 0.00     |
| <u>Organic Amines</u>          |                    |          |
| Monomethylamine                | 0.05               | 0.02     |
| Monoethylamine & dimethylamine | 0.03               | 0.02     |
| Trimethylamine                 | 0.00               | 0.00     |
| Diethylamine                   | 0.00               | 0.00     |
| Triethylamine                  | 0.00               | 0.00     |

|                                | Emissions in ppm |      |          |      |
|--------------------------------|------------------|------|----------|------|
|                                | COLD-UDDS        |      | HOT-UDDS |      |
|                                | 1                | 2    | 3        | 4    |
| <u>Individual Hydrocarbons</u> |                  |      |          |      |
| Methane                        | 5.70             | 0.62 | 1.81     | 0.80 |
| Ethylene                       | 5.16             | 0.08 | 0.42     | 0.08 |
| Ethane                         | 1.02             | 0.08 | 0.31     | 0.08 |
| Acetylene                      | 1.64             | 0.00 | 0.00     | 0.00 |
| Propane                        | 0.22             | 0.02 | 0.01     | 0.15 |
| Propylene                      | 2.93             | 0.00 | 0.27     | 0.00 |
| Benzene                        | 2.29             | 0.02 | 0.29     | 0.05 |
| Toluene                        | 2.37             | 0.05 | 0.15     | 0.00 |
| <u>Other</u>                   |                  |      |          |      |
| Nitrous Oxide                  | 0.65             | 0.17 | 1.31     | 0.28 |
| Nickel Carbonyl                | 0.00             | 0.00 | 0.00     | 0.00 |

TABLE C-67. PTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test 233111, Fuel No. 1, 15,000 Miles

|                                | Emissions in mg/km |          |          |      |
|--------------------------------|--------------------|----------|----------|------|
|                                | COLD-UDDS          | HOT-UDDS |          |      |
| Sulfates                       | 0.20               | 0.00     |          |      |
| Ammonia                        | 1.98               | 0.78     |          |      |
| Cyanides & Cyanogen            | 3.25               | 1.98     |          |      |
| Hydrogen Sulfide               | 0.00               | 0.00     |          |      |
| Sulfur Dioxide                 | 22.69              | 47.43    |          |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |          |      |
| Formaldehyde                   | 0.00               | 0.00     |          |      |
| Acetaldehyde                   | 0.49               | 1.06     |          |      |
| Acetone                        | 0.00               | 0.00     |          |      |
| Isobutyraldehyde               | 0.70               | 3.17     |          |      |
| Methyl ethyl ketone            | 0.00               | 0.11     |          |      |
| Crotonaldehyde                 | ----               | ----     |          |      |
| Hexanaldehyde                  | 0.20               | 0.46     |          |      |
| Benzaldehyde                   | ----               | ----     |          |      |
| <u>Organic Sulfides</u>        |                    |          |          |      |
| Carbonyl sulfide               | 0.00               | 0.00     |          |      |
| Methyl sulfide                 | 0.00               | 0.05     |          |      |
| Ethyl sulfide                  | 0.00               | 0.00     |          |      |
| Methyl disulfide               | 0.00               | 0.00     |          |      |
| <u>Organic Amines</u>          |                    |          |          |      |
| Monomethylamine                | 0.00               | 0.00     |          |      |
| Monoethylamine & dimethylamine | 0.01               | 0.02     |          |      |
| Trimethylamine                 | 0.00               | 0.00     |          |      |
| Diethylamine                   | 0.00               | 0.00     |          |      |
| Triethylamine                  | 0.00               | 0.00     |          |      |
| <br>Emissions in ppm           |                    |          |          |      |
|                                | COLD-UDDS          |          | HOT-UDDS |      |
|                                | 1                  | 2        | 3        | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |          |      |
| Methane                        | 4.55               | 0.83     | 1.85     | 0.87 |
| Ethylene                       | 4.11               | 0.02     | 0.48     | 0.02 |
| Ethane                         | 0.74               | 0.03     | 0.27     | 0.05 |
| Acetylene                      | 1.45               | 0.00     | 0.02     | 0.00 |
| Propane                        | 0.00               | 0.00     | 0.42     | 0.17 |
| Propylene                      | 2.22               | 0.00     | 0.24     | 0.00 |
| Benzene                        | 7.82               | 0.12     | 2.83     | 0.96 |
| Toluene                        | 4.04               | 0.00     | 1.17     | 0.20 |
| <u>Other</u>                   |                    |          |          |      |
| Nitrous Oxide                  | 0.85               | 0.40     | ----     | 0.31 |
| Nickel Carbonyl                | 0.00               | 0.00     | 0.00     | 0.00 |

TABLE C-68. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test 233121, Fuel No. 1, 15,000 Miles

|                                | Emissions in mg/km |          |      |      |
|--------------------------------|--------------------|----------|------|------|
|                                | COLD-UDDS          | HOT-UDDS |      |      |
| Sulfates                       | 0.14               | 0.00     |      |      |
| Ammonia                        | 0.76               | 0.94     |      |      |
| Cyanides & Cyanogen            | 3.44               | 2.46     |      |      |
| Hydrogen Sulfide               | 0.00               | 0.00     |      |      |
| Sulfur Dioxide                 | 21.60              | 14.31    |      |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |      |      |
| Formaldehyde                   | 0.66               | 0.00     |      |      |
| Acetaldehyde                   | 0.00               | 0.00     |      |      |
| Acetone                        | 0.00               | 0.00     |      |      |
| Isobutyraldehyde               | 16.32              | 9.99     |      |      |
| Methyl ethyl ketone            | 0.34               | 0.33     |      |      |
| Crotonaldehyde                 | ----               | ----     |      |      |
| Hexanaldehyde                  | 0.34               | 0.47     |      |      |
| Benzaldehyde                   | ----               | ----     |      |      |
| <u>Organic Sulfides</u>        |                    |          |      |      |
| Carbonyl sulfide               | 0.00               | 0.00     |      |      |
| Methyl sulfide                 | 0.00               | 0.00     |      |      |
| Ethyl sulfide                  | 0.00               | 0.00     |      |      |
| Methyl disulfide               | 0.00               | 0.00     |      |      |
| <u>Organic Amines</u>          |                    |          |      |      |
| Monomethylamine                | 0.01               | 0.01     |      |      |
| Monoethylamine & dimethylamine | 0.00               | 0.00     |      |      |
| Trimethylamine                 | 0.00               | 0.00     |      |      |
| Diethylamine                   | 0.00               | 0.00     |      |      |
| Triethylamine                  | 0.00               | 0.00     |      |      |
|                                | Emissions in ppm   |          |      |      |
|                                | COLD-UDDS          | HOT-UDDS |      |      |
|                                | 1                  | 2        | 3    | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |      |      |
| Methane                        | 5.95               | 0.99     | 2.14 | 0.76 |
| Ethylene                       | 4.99               | 0.08     | 0.77 | 0.05 |
| Ethane                         | 0.82               | 0.05     | 0.29 | 0.06 |
| Acetylene                      | 2.00               | 0.01     | 0.03 | 0.00 |
| Propane                        | 0.00               | 0.00     | 0.00 | 0.00 |
| Propylene                      | 2.46               | 0.03     | 0.28 | 0.00 |
| Benzene                        | 12.29              | 0.02     | 1.69 | 0.24 |
| Toluene                        | 6.65               | 0.03     | 0.36 | 0.02 |
| <u>Other</u>                   |                    |          |      |      |
| Nitrous Oxide                  | 0.74               | 0.31     | 1.48 | 0.23 |
| Nickel Carbonyl                | ----               | ----     | ---- | ---- |

TABLE C-69. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test 233211 - Fuel No. 2, 15,000 Miles

|                                | Emissions in mg/km |          |      |      |
|--------------------------------|--------------------|----------|------|------|
|                                | COLD-UDDS          | HOT-UDDS |      |      |
| Sulfates                       | 0.19               | 0.00     |      |      |
| Ammonia                        | 0.86               | 2.64     |      |      |
| Cyanides & Cyanogen            | 3.00               | 2.02     |      |      |
| Hydrogen Sulfide               | 0.00               | 0.00     |      |      |
| Sulfur Dioxide                 | 41.08              | 34.21    |      |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |      |      |
| Formaldehyde                   | 0.58               | 0.04     |      |      |
| Acetaldehyde                   | 0.82               | 0.93     |      |      |
| Acetone                        | 0.00               | 0.00     |      |      |
| Isobutyraldehyde               | 5.43               | 6.43     |      |      |
| Methyl ethyl ketone            | 0.65               | 0.74     |      |      |
| Crotonaldehyde                 | ----               | ----     |      |      |
| Hexanaldehyde                  | 0.62               | 0.73     |      |      |
| Benzaldehyde                   | ----               | ----     |      |      |
| <u>Organic Sulfides</u>        |                    |          |      |      |
| Carbonyl sulfide               | 0.00               | 0.00     |      |      |
| Methyl sulfide                 | 0.00               | 0.00     |      |      |
| Ethyl sulfide                  | 0.00               | 0.00     |      |      |
| Methyl disulfide               | 0.00               | 0.00     |      |      |
| <u>Organic Amines</u>          |                    |          |      |      |
| Monomethylamine                | 0.04               | 0.00     |      |      |
| Monoethylamine & dimethylamine | 0.03               | 0.00     |      |      |
| Trimethylamine                 | 0.04               | 0.06     |      |      |
| Diethylamine                   | 0.00               | 0.00     |      |      |
| Triethylamine                  | 0.00               | 0.00     |      |      |
|                                | Emissions in ppm   |          |      |      |
|                                | COLD-UDDS          | HOT-UDDS |      |      |
|                                | 1                  | 2        | 3    | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |      |      |
| Methane                        | 5.36               | 1.04     | 2.01 | 0.78 |
| Ethylene                       | 4.87               | 0.03     | 0.58 | 0.01 |
| Ethane                         | 0.89               | 0.00     | 0.31 | 0.01 |
| Acetylene                      | 1.50               | 0.00     | 0.00 | 0.00 |
| Propane                        | 0.00               | 0.00     | 0.00 | 0.00 |
| Propylene                      | 2.39               | 0.00     | 0.20 | 0.00 |
| Benzene                        | 5.52               | 2.18     | 0.82 | 0.05 |
| Toluene                        | 8.17               | 0.04     | 0.45 | 0.00 |
| <u>Other</u>                   |                    |          |      |      |
| Nitrous Oxide                  | 1.08               | 0.31     | 1.97 | 0.42 |
| Nickel Carbonyl                | 0.00               | 0.00     | 0.00 | 0.00 |

TABLE C-70. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test 233221 - Fuel No. 2, 15,000 Miles

|                                | Emissions in mg/km |          |      |      |
|--------------------------------|--------------------|----------|------|------|
|                                | COLD-UDDS          | HOT-UDDS |      |      |
| Sulfates                       | 0.01               | 0.00     |      |      |
| Ammonia                        | 1.27               | 2.47     |      |      |
| Cyanides & Cyanogen            | 2.49               | 1.85     |      |      |
| Hydrogen Sulfide               | 0.00               | 0.00     |      |      |
| Sulfur Dioxide                 | 39.05              | 37.84    |      |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |      |      |
| Formaldehyde                   | 0.03               | 0.00     |      |      |
| Acetaldehyde                   | 0.16               | 0.00     |      |      |
| Acetone                        | 0.00               | 0.00     |      |      |
| Isobutyraldehyde               | 0.00               | 0.00     |      |      |
| Methyl ethyl ketone            | 0.00               | 0.00     |      |      |
| Crotonaldehyde                 | ----               | ----     |      |      |
| Hexanaldehyde                  | 0.08               | 0.17     |      |      |
| Benzaldehyde                   | ----               | ----     |      |      |
| <u>Organic Sulfides</u>        |                    |          |      |      |
| Carbonyl sulfide               | 0.00               | 0.00     |      |      |
| Methyl sulfide                 | 0.00               | 0.00     |      |      |
| Ethyl sulfide                  | 0.00               | 0.00     |      |      |
| Methyl disulfide               | 0.00               | 0.00     |      |      |
| <u>Organic Amines</u>          |                    |          |      |      |
| Monomethylamine                | 0.02               | 0.00     |      |      |
| Monoethylamine & dimethylamine | 0.03               | 0.01     |      |      |
| Trimethylamine                 | 0.00               | 0.00     |      |      |
| Diethylamine                   | 0.00               | 0.00     |      |      |
| Triethylamine                  | 0.00               | 0.00     |      |      |
| <u>Emissions in ppm</u>        |                    |          |      |      |
|                                | COLD-UDDS          | HOT-UDDS |      |      |
|                                | 1                  | 2        | 3    | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |      |      |
| Methane                        | 4.13               | 1.08     | 1.82 | 0.68 |
| Ethylene                       | 3.41               | 0.07     | 0.51 | 0.09 |
| Ethane                         | 0.66               | 0.01     | 0.29 | 0.09 |
| Acetylene                      | 1.72               | 0.00     | 0.02 | 0.00 |
| Propane                        | 0.00               | 0.00     | 0.00 | 0.00 |
| Propylene                      | 1.85               | 0.00     | 0.23 | 0.00 |
| Benzene                        | 5.24               | 0.15     | 0.80 | 0.12 |
| Toluene                        | 8.59               | 0.09     | 0.42 | 0.02 |
| <u>Other</u>                   |                    |          |      |      |
| Nitrous Oxide                  | 1.65               | 0.29     | 1.33 | 0.43 |
| Nickel Carbonyl                | ----               | ----     | ---- | ---- |



TABLE C-7L FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test 233311 - Fuel No. 3, 15,000 Miles

|                                | Emissions in mg/km |          |          |      |
|--------------------------------|--------------------|----------|----------|------|
|                                | COLD-UDDS          | HOT-UDDS |          |      |
| Sulfates                       | 0.37               | 0.00     |          |      |
| Ammonia                        | 4.74               | 2.63     |          |      |
| Cyanides & Cyanogen            | 2.84               | 2.16     |          |      |
| Hydrogen Sulfide               | 0.00               | 0.00     |          |      |
| Sulfur Dioxide                 | 49.89              | 21.79    |          |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |          |      |
| Formaldehyde                   | 1.98               | 0.10     |          |      |
| Acetaldehyde                   | 1.42               | 0.65     |          |      |
| Acetone                        | 0.00               | 0.00     |          |      |
| Isobutyraldehyde               | 7.50               | 3.66     |          |      |
| Methyl ethyl ketone            | 0.60               | 0.79     |          |      |
| Crotonaldehyde                 | ----               | ----     |          |      |
| Hexanaldehyde                  | 0.87               | 0.96     |          |      |
| Benzaldehyde                   | ----               | ----     |          |      |
| <u>Organic Sulfides</u>        |                    |          |          |      |
| Carbonyl sulfide               | 0.00               | 0.00     |          |      |
| Methyl sulfide                 | 0.00               | 0.03     |          |      |
| Ethyl sulfide                  | 0.00               | 0.00     |          |      |
| Methyl disulfide               | 0.00               | 0.00     |          |      |
| <u>Organic Amines</u>          |                    |          |          |      |
| Monomethylamine                | 0.00               | 0.00     |          |      |
| Monoethylamine & dimethylamine | 0.00               | 0.00     |          |      |
| Trimethylamine                 | 0.05               | 0.00     |          |      |
| Diethylamine                   | 0.00               | 0.00     |          |      |
| Triethylamine                  | 0.00               | 0.00     |          |      |
| <u>Emissions in ppm</u>        |                    |          |          |      |
|                                | COLD-UDDS          |          | HOT-UDDS |      |
|                                | 1                  | 2        | 3        | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |          |      |
| Methane                        | 4.95               | 0.02     | 1.21     | 0.00 |
| Ethylene                       | 4.75               | 0.00     | 0.45     | 0.00 |
| Ethane                         | 0.76               | 0.00     | 0.20     | 0.00 |
| Acetylene                      | 1.79               | 0.00     | 0.04     | 0.00 |
| Propane                        | 0.00               | 0.00     | 0.00     | 0.00 |
| Propylene                      | 2.41               | 0.00     | 0.16     | 0.00 |
| Benzene                        | 2.41               | 0.08     | 0.35     | 0.00 |
| Toluene                        | 3.27               | 0.00     | 0.27     | 0.00 |
| <u>Other</u>                   |                    |          |          |      |
| Nitrous Oxide                  | 1.05               | 0.21     | 1.93     | 0.30 |
| Nickel Carbonyl                | ----               | ----     | ----     | ---- |

TABLE C-72. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test 233321 - Fuel No. 3, 15,000 Miles

|                                | Emissions in mg/km |          |          |      |
|--------------------------------|--------------------|----------|----------|------|
|                                | COLD-UDDS          | HOT-UDDS |          |      |
| Sulfates                       | 0.11               | 0.02     |          |      |
| Ammonia                        | 1.57               | 1.07     |          |      |
| Cyanides & Cyanogen            | 2.19               | 1.87     |          |      |
| Hydrogen Sulfide               | 0.00               | 0.00     |          |      |
| Sulfur Dioxide                 | 37.19              | 28.32    |          |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |          |      |
| Formaldehyde                   | 0.03               | 0.26     |          |      |
| Acetaldehyde                   | 0.58               | 1.49     |          |      |
| Acetone                        | 0.00               | 0.00     |          |      |
| Isobutyraldehyde               | 0.10               | 6.66     |          |      |
| Methyl ethyl ketone            | 0.59               | 0.78     |          |      |
| Crotonaldehyde                 | ----               | ----     |          |      |
| Hexanaldehyde                  | 0.51               | 0.86     |          |      |
| Benzaldehyde                   | ----               | ----     |          |      |
| <u>Organic Sulfides</u>        |                    |          |          |      |
| Carbonyl sulfide               | 0.00               | 0.00     |          |      |
| Methyl sulfide                 | 0.00               | 0.00     |          |      |
| Ethyl sulfide                  | 0.00               | 0.00     |          |      |
| Methyl disulfide               | 0.00               | 0.00     |          |      |
| <u>Organic Amines</u>          |                    |          |          |      |
| Monomethylamine                | 0.02               | 0.01     |          |      |
| Monoethylamine & dimethylamine | 0.02               | 0.00     |          |      |
| Trimethylamine                 | 0.00               | 0.02     |          |      |
| Diethylamine                   | 0.00               | 0.00     |          |      |
| Triethylamine                  | 0.00               | 0.00     |          |      |
| <u>Emissions in ppm</u>        |                    |          |          |      |
|                                | COLD-UDDS          |          | HOT-UDDS |      |
|                                | 1                  | 2        | 3        | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |          |      |
| Methane                        | 7.02               | 1.51     | 2.93     | 1.09 |
| Ethylene                       | 6.34               | 0.12     | 0.86     | 0.08 |
| Ethane                         | 1.30               | 0.08     | 0.43     | 0.06 |
| Acetylene                      | 2.22               | 0.00     | 0.01     | 0.00 |
| Propane                        | 0.00               | 0.00     | 0.00     | 0.00 |
| Propylene                      | 3.63               | 0.00     | 0.46     | 0.02 |
| Benzene                        | 3.39               | 0.10     | 0.49     | 0.10 |
| Toluene                        | 3.54               | 0.00     | 0.25     | 0.02 |
| <u>Other</u>                   |                    |          |          |      |
| Nitrous Oxide                  | 0.68               | 0.15     | 1.13     | 0.25 |
| Nickel Carbonyl                | 0.00               | 0.00     | 0.00     | 0.00 |

TABLE C-73. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
TEST 240111 - FUEL #1, INITIAL MILEAGE

|                                | Emissions in mg/km |          |
|--------------------------------|--------------------|----------|
|                                | COLD-UDDS          | HOT-UDDS |
| Sulfates                       | 0.30               | 0.06     |
| Ammonia                        | 5.90               | 2.53     |
| Cyanides & Cyanogen            | 0.63               | 0.08     |
| Hydrogen Sulfide               | 0.00               | 0.00     |
| Sulfur Dioxide                 | ----               | ----     |
| <u>Aldehydes &amp; Ketones</u> |                    |          |
| Formaldehyde                   | 2.63               | 2.80     |
| Acetaldehyde                   | 0.00               | 0.00     |
| Acetone                        | 0.00               | 0.00     |
| Isobutyraldehyde               | 0.00               | 0.00     |
| Methyl ethyl ketone            | 0.00               | 0.00     |
| Crotonaldehyde                 | ----               | ----     |
| Hexanaldehyde                  | 0.00               | 0.00     |
| Benzaldehyde                   | ----               | ----     |
| <u>Organic Sulfides</u>        |                    |          |
| Carbonyl sulfide               | 0.00               | 0.00     |
| Methyl sulfide                 | 0.00               | 0.00     |
| Ethyl sulfide                  | 0.16               | 0.00     |
| Methyl disulfide               | 0.07               | 0.00     |
| <u>Organic Amines</u>          |                    |          |
| Monomethylamine                | 0.00               | 0.00     |
| Monoethylamine & dimethylamine | 0.00               | 0.00     |
| Trimethylamine                 | 0.00               | 0.00     |
| Diethylamine                   | 0.00               | 0.00     |
| Triethylamine                  | 0.00               | 0.00     |

|                                | Emissions in ppm |      |          |      |
|--------------------------------|------------------|------|----------|------|
|                                | COLD-UDDS        |      | HOT-UDDS |      |
|                                | 1                | 2    | 3        | 4    |
| <u>Individual Hydrocarbons</u> |                  |      |          |      |
| Methane                        | 5.17             | 4.37 | 3.39     | 4.53 |
| Ethylene                       | 1.32             | 0.05 | 0.27     | 0.00 |
| Ethane                         | 0.80             | 0.28 | 0.58     | 0.27 |
| Acetylene                      | 0.37             | 0.00 | 0.00     | 0.00 |
| Propane                        | 0.11             | 0.00 | 0.05     | 0.00 |
| Propylene                      | 0.73             | 0.00 | 0.02     | 0.00 |
| Benzene                        | 2.73             | 0.05 | 0.57     | 0.05 |
| Toluene                        | 4.75             | 0.08 | 0.15     | 0.10 |
| <u>Other</u>                   |                  |      |          |      |
| Nitrous Oxide                  | 1.79             | 0.19 | 1.48     | 0.25 |
| Nickel Carbonyl                | 0.00             | 0.00 | 0.00     | 0.00 |

TABLE C-74. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
TEST 240121 - FUEL #1, INITIAL MILEAGE

|                                | Emissions in mg/km |          |      |      |
|--------------------------------|--------------------|----------|------|------|
|                                | COLD-UDDS          | HOT-UDDS |      |      |
| Sulfates                       | 0.15               | 0.02     |      |      |
| Ammonia                        | 0.44               | 0.00     |      |      |
| Cyanides & Cyanogen            | 0.36               | 0.15     |      |      |
| Hydrogen Sulfide               | 0.00               | 0.00     |      |      |
| Sulfur Dioxide                 | ---                | ---      |      |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |      |      |
| Formaldehyde                   | 2.63               | 3.77     |      |      |
| Acetaldehyde                   | 0.89               | 0.09     |      |      |
| Acetone                        | 0.92               | 0.00     |      |      |
| Isobutyraldehyde               | 0.00               | 0.39     |      |      |
| Methyl ethyl ketone            | 0.64               | 0.00     |      |      |
| Crotonaldehyde                 | ---                | ---      |      |      |
| Hexanaldehyde                  | 0.00               | 0.00     |      |      |
| Benzaldehyde                   | ---                | ---      |      |      |
| <u>Organic Sulfides</u>        |                    |          |      |      |
| Carbonyl sulfide               | 0.00               | 0.22     |      |      |
| Methyl sulfide                 | 0.00               | 0.12     |      |      |
| Ethyl sulfide                  | 0.06               | 0.04     |      |      |
| Methyl disulfide               | 0.03               | 0.04     |      |      |
| <u>Organic Amines</u>          |                    |          |      |      |
| Monomethylamine                | 0.00               | 0.00     |      |      |
| Monoethylamine & dimethylamine | 0.00               | 0.00     |      |      |
| Trimethylamine                 | 0.00               | 0.00     |      |      |
| Diethylamine                   | 0.00               | 0.00     |      |      |
| Triethylamine                  | 0.00               | 0.00     |      |      |
|                                | Emissions in ppm   |          |      |      |
|                                | COLD-UDDS          | HOT-UDDS |      |      |
|                                | 1                  | 2        | 3    | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |      |      |
| Methane                        | 5.31               | 3.90     | 4.09 | 5.26 |
| Ethylene                       | 1.35               | 0.05     | 0.44 | 0.00 |
| Ethane                         | 0.79               | 0.27     | 0.74 | 0.37 |
| Acetylene                      | 0.33               | 0.00     | 0.00 | 0.00 |
| Propane                        | 0.11               | 0.00     | 0.08 | 0.00 |
| Propylene                      | 0.66               | 0.00     | 0.08 | 0.00 |
| Benzene                        | 2.38               | 0.10     | 0.67 | 0.10 |
| Toluene                        | 3.50               | 0.10     | 0.20 | 0.00 |
| <u>Other</u>                   |                    |          |      |      |
| Nitrous Oxide                  | 1.23               | 0.13     | 1.53 | 0.24 |
| Nickel Carbonyl                | 0.00               | 0.00     | 0.00 | 0.00 |

TABLE C-75. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
TEST 240211 - FUEL #2, INITIAL MILEAGE

|                                | Emissions in mg/km |          |
|--------------------------------|--------------------|----------|
|                                | COLD-UDDS          | HOT-UDDS |
| Sulfates                       | 0.98               | 0.18     |
| Ammonia                        | 0.00               | 5.19     |
| Cyanides & Cyanogen            | 6.11               | 5.43     |
| Hydrogen Sulfide               | 0.00               | 0.13     |
| Sulfur Dioxide                 | ----               | ----     |
| <u>Aldehydes &amp; Ketones</u> |                    |          |
| Formaldehyde                   | 7.89               | 3.03     |
| Acetaldehyde                   | 0.00               | 0.00     |
| Acetone                        | 0.23               | 0.64     |
| Isobutyraldehyde               | 0.00               | 0.00     |
| Methyl ethyl ketone            | 0.00               | 0.00     |
| Crotonaldehyde                 | ----               | ----     |
| Hexanaldehyde                  | 0.00               | 0.00     |
| Benzaldehyde                   | ----               | ----     |
| <u>Organic Sulfides</u>        |                    |          |
| Carbonyl sulfide               | 0.00               | 0.01     |
| Methyl sulfide                 | 0.00               | 0.00     |
| Ethyl sulfide                  | 0.26               | 0.00     |
| Methyl disulfide               | 0.03               | 0.00     |
| <u>Organic Amines</u>          |                    |          |
| Monomethylamine                | 0.00               | 0.00     |
| Monoethylamine & dimethylamine | 0.00               | 0.00     |
| Trimethylamine                 | 0.00               | 0.00     |
| Diethylamine                   | 0.00               | 0.00     |
| Triethylamine                  | 0.00               | 0.00     |

|                                | Emissions in ppm |      |          |      |
|--------------------------------|------------------|------|----------|------|
|                                | COLD-UDDS        |      | HOT-UDDS |      |
|                                | 1                | 2    | 3        | 4    |
| <u>Individual Hydrocarbons</u> |                  |      |          |      |
| Methane                        | 6.01             | 4.88 | 4.02     | 4.18 |
| Ethylene                       | 1.12             | 0.46 | 0.49     | 0.00 |
| Ethane                         | 0.77             | 0.34 | 0.73     | 0.31 |
| Acetylene                      | 0.39             | 0.00 | 0.00     | 0.00 |
| Propane                        | 0.26             | 0.03 | 0.07     | 0.00 |
| Propylene                      | 0.56             | 0.08 | 0.05     | 0.00 |
| Benzene                        | 2.31             | 0.25 | 1.01     | 0.05 |
| Toluene                        | 3.06             | 0.40 | 0.82     | 0.03 |
| <u>Other</u>                   |                  |      |          |      |
| Nitrous Oxide                  | 1.34             | 0.19 | 1.48     | 0.27 |
| Nickel Carbonyl                | 0.00             | 0.00 | 0.00     | 0.00 |

TABLE C-76. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
TEST 240221 - FUEL #2, INITIAL MILEAGE

|                                | Emissions in mg/km |          |      |      |
|--------------------------------|--------------------|----------|------|------|
|                                | COLD-UDDS          | HOT-UDDS |      |      |
| Sulfates                       | 0.54               | 0.21     |      |      |
| Ammonia                        | 6.87               | 2.06     |      |      |
| Cyanides & Cyanogen            | 3.12               | 1.10     |      |      |
| Hydrogen Sulfide               | 0.00               | 0.00     |      |      |
| Sulfur Dioxide                 | ----               | ----     |      |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |      |      |
| Formaldehyde                   | 3.02               | 4.33     |      |      |
| Acetaldehyde                   | 0.20               | 0.00     |      |      |
| Acetone                        | 0.00               | 0.00     |      |      |
| Isobutyraldehyde               | 0.00               | 0.00     |      |      |
| Methyl ethyl ketone            | 0.00               | 0.00     |      |      |
| Crotonaldehyde                 | ----               | ----     |      |      |
| Hexanaldehyde                  | 0.00               | 0.00     |      |      |
| Benzaldehyde                   | ----               | ----     |      |      |
| <u>Organic Sulfides</u>        |                    |          |      |      |
| Carbonyl sulfide               | 0.03               | 0.02     |      |      |
| Methyl sulfide                 | 0.01               | 0.02     |      |      |
| Ethyl sulfide                  | 0.21               | 0.00     |      |      |
| Methyl disulfide               | 0.03               | 0.00     |      |      |
| <u>Organic Amines</u>          |                    |          |      |      |
| Monomethylamine                | 0.00               | 0.00     |      |      |
| Monoethylamine & dimethylamine | 0.00               | 0.00     |      |      |
| Trimethylamine                 | 0.00               | 0.00     |      |      |
| Diethylamine                   | 0.00               | 0.00     |      |      |
| Triethylamine                  | 0.00               | 0.00     |      |      |
|                                | Emissions in ppm   |          |      |      |
|                                | COLD-UDDS          | HOT-UDDS |      |      |
|                                | 1                  | 2        | 3    | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |      |      |
| Methane                        | 5.99               | 5.17     | 4.15 | 4.22 |
| Ethylene                       | 1.55               | 0.45     | 0.58 | 0.04 |
| Ethane                         | 0.90               | 0.34     | 0.75 | 0.28 |
| Acetylene                      | 0.37               | 0.32     | 0.00 | 0.00 |
| Propane                        | 0.21               | 0.10     | 0.15 | 0.00 |
| Propylene                      | 0.76               | 0.29     | 0.12 | 0.00 |
| Benzene                        | 2.30               | 0.47     | 0.90 | 0.01 |
| Toluene                        | 3.41               | 0.44     | 0.44 | 0.00 |
| <u>Other</u>                   |                    |          |      |      |
| Nitrous Oxide                  | 2.04               | 0.19     | 1.16 | 0.13 |
| Nickel Carbonyl                | 0.00               | 0.00     | 0.00 | 0.00 |

TABLE C-77. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
TEST 240311 - FUEL #3, INITIAL MILEAGE

|                                | Emissions in mg/km |          |          |      |
|--------------------------------|--------------------|----------|----------|------|
|                                | COLD-UDDS          | HOT-UDDS |          |      |
| Sulfates                       | 0.30               | 0.23     |          |      |
| Ammonia                        | 1.12               | 2.06     |          |      |
| Cyanides & Cyanogen            | 7.70               | 1.37     |          |      |
| Hydrogen Sulfide               | 0.00               | 0.00     |          |      |
| Sulfur Dioxide                 | ----               | ----     |          |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |          |      |
| Formaldehyde                   | 5.64               | 5.00     |          |      |
| Acetaldehyde                   | 1.26               | 1.05     |          |      |
| Acetone                        | 0.60               | 0.08     |          |      |
| Isobutyraldehyde               | 0.00               | 0.00     |          |      |
| Methyl ethyl ketone            | 0.00               | 0.00     |          |      |
| Crotonaldehyde                 | ----               | ----     |          |      |
| Hexanaldehyde                  | 0.00               | 0.00     |          |      |
| Benzaldehyde                   | ----               | ----     |          |      |
| <u>Organic Sulfides</u>        |                    |          |          |      |
| Carbonyl sulfide               | 0.39               | 0.11     |          |      |
| Methyl sulfide                 | 0.00               | 0.02     |          |      |
| Ethyl sulfide                  | 0.03               | 0.00     |          |      |
| Methyl disulfide               | 0.00               | 0.00     |          |      |
| <u>Organic Amines</u>          |                    |          |          |      |
| Monomethylamine                | 0.10               | 0.00     |          |      |
| Monoethylamine & dimethylamine | 0.05               | 0.00     |          |      |
| Trimethylamine                 | 0.00               | 0.00     |          |      |
| Diethylamine                   | 0.00               | 0.00     |          |      |
| Triethylamine                  | 0.00               | 0.00     |          |      |
|                                | Emissions in ppm   |          |          |      |
|                                | COLD-UDDS          |          | HOT-UDDS |      |
|                                | 1                  | 2        | 3        | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |          |      |
| Methane                        | 6.65               | 3.82     | 4.35     | 3.98 |
| Ethylene                       | 1.45               | 0.02     | 0.34     | 0.03 |
| Ethane                         | 1.10               | 0.36     | 0.65     | 0.42 |
| Acetylene                      | 0.52               | 0.00     | 0.00     | 0.00 |
| Propane                        | ----               | ----     | ----     | ---- |
| Propylene                      | 0.88               | 0.00     | 0.02     | 0.00 |
| Benzene                        | 0.73               | 0.00     | 0.07     | 0.00 |
| Toluene                        | 0.51               | 0.00     | 0.00     | 0.00 |
| <u>Other</u>                   |                    |          |          |      |
| Nitrous Oxide                  | 1.09               | 0.15     | 0.93     | 0.25 |
| Nickel Carbonyl                | 0.00               | 0.00     | 0.00     | 0.00 |



TABLE C-78. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
TEST 240321 - FUEL #3, INITIAL MILEAGE

|                                | Emissions in mg/km |          |
|--------------------------------|--------------------|----------|
|                                | COLD-UDDS          | HOT-UDDS |
| Sulfates                       | 0.86               | 0.84     |
| Ammonia                        | 4.34               | 1.24     |
| Cyanides & Cyanogen            | 1.43               | 0.14     |
| Hydrogen Sulfide               | 0.00               | 0.00     |
| Sulfur Dioxide                 | ----               | ----     |
| <u>Aldehydes &amp; Ketones</u> |                    |          |
| Formaldehyde                   | 1.73               | 1.62     |
| Acetaldehyde                   | 0.00               | 0.21     |
| Acetone                        | 0.00               | 0.00     |
| Isobutyraldehyde               | 0.00               | 0.00     |
| Methyl ethyl ketone            | 0.00               | 0.00     |
| Crotonaldehyde                 | ----               | ----     |
| Hexanaldehyde                  | 0.00               | 0.00     |
| Benzaldehyde                   | ----               | ----     |
| <u>Organic Sulfides</u>        |                    |          |
| Carbonyl sulfide               | 0.00               | 0.03     |
| Methyl sulfide                 | 0.00               | 0.03     |
| Ethyl sulfide                  | 0.08               | 0.00     |
| Methyl disulfide               | 0.01               | 0.00     |
| <u>Organic Amines</u>          |                    |          |
| Monomethylamine                | 0.00               | 0.00     |
| Monoethylamine & dimethylamine | 0.00               | 0.00     |
| Trimethylamine                 | 0.00               | 0.00     |
| Diethylamine                   | 0.00               | 0.00     |
| Triethylamine                  | 0.00               | 0.00     |

|                                | Emissions in ppm |      |          |      |
|--------------------------------|------------------|------|----------|------|
|                                | COLD-UDDS        |      | HOT-UDDS |      |
|                                | 1                | 2    | 3        | 4    |
| <u>Individual Hydrocarbons</u> |                  |      |          |      |
| Methane                        | 7.50             | 3.97 | 5.16     | 5.03 |
| Ethylene                       | 1.44             | 0.00 | 0.29     | 0.01 |
| Ethane                         | 1.11             | 0.47 | 0.92     | 0.65 |
| Acetylene                      | 0.39             | 0.00 | 0.00     | 0.00 |
| Propane                        | 0.49             | 0.31 | 0.34     | 0.18 |
| Propylene                      | 0.90             | 0.00 | 0.12     | 0.00 |
| Benzene                        | 0.66             | 0.00 | 0.20     | 0.00 |
| Toluene                        | 0.31             | 0.00 | 0.02     | 0.00 |
| <u>Other</u>                   |                  |      |          |      |
| Nitrous Oxide                  | 1.64             | 0.17 | 1.25     | 0.33 |
| Nickel Carbonyl                | 0.00             | 0.00 | 0.00     | 0.00 |

TABLE C-79. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test 241111 - Fuel No. 1, 5000 Miles

|                                | Emissions in mg/km |          |      |      |
|--------------------------------|--------------------|----------|------|------|
|                                | COLD-UDDS          | HOT-UDDS |      |      |
| Sulfates                       | 0.35               | 0.13     |      |      |
| Ammonia                        | 1.28               | 1.58     |      |      |
| Cyanides & Cyanogen            | 0.00               | 0.00     |      |      |
| Hydrogen Sulfide               | 0.00               | 0.00     |      |      |
| Sulfur Dioxide                 | ----               | ----     |      |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |      |      |
| Formaldehyde                   | 5.53               | 3.57     |      |      |
| Acetaldehyde                   | 0.21               | 0.21     |      |      |
| Acetone                        | 0.00               | 0.00     |      |      |
| Isobutyraldehyde               | 0.00               | 0.20     |      |      |
| Methyl ethyl ketone            | 0.00               | 0.00     |      |      |
| Crotonaldehyde                 | ----               | ----     |      |      |
| Hexanaldehyde                  | 0.00               | 0.00     |      |      |
| Benzaldehyde                   | ----               | ----     |      |      |
| <u>Organic Sulfides</u>        |                    |          |      |      |
| Carbonyl sulfide               | ----               | 0.22     |      |      |
| Methyl sulfide                 | ----               | 0.12     |      |      |
| Ethyl sulfide                  | ----               | 0.00     |      |      |
| Methyl disulfide               | ----               | 0.02     |      |      |
| <u>Organic Amines</u>          |                    |          |      |      |
| Monomethylamine                | 0.01               | 0.00     |      |      |
| Monoethylamine & dimethylamine | 0.01               | 0.00     |      |      |
| Trimethylamine                 | 0.00               | 0.00     |      |      |
| Diethylamine                   | 0.00               | 0.00     |      |      |
| Triethylamine                  | 0.00               | 0.00     |      |      |
|                                | Emissions in ppm   |          |      |      |
|                                | COLD-UDDS          | HOT-UDDS |      |      |
|                                | 1                  | 2        | 3    | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |      |      |
| Methane                        | 5.48               | 5.05     | 4.73 | 5.24 |
| Ethylene                       | 1.22               | 0.02     | 0.66 | 0.00 |
| Ethane                         | 0.84               | 0.49     | 0.80 | 0.49 |
| Acetylene                      | 0.62               | 0.00     | 0.00 | 0.00 |
| Propane                        | 0.16               | 0.02     | 0.13 | 0.02 |
| Propylene                      | 0.52               | 0.00     | 0.10 | 0.00 |
| Benzene                        | 2.33               | 0.10     | 1.07 | 0.15 |
| Toluene                        | 2.94               | 0.00     | 0.36 | 0.00 |
| <u>Other</u>                   |                    |          |      |      |
| Nitrous Oxide                  | 1.20               | 0.17     | 1.62 | 0.32 |
| Nickel Carbonyl                | 0.00               | 0.00     | 0.00 | 0.00 |

TABLE C-80. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test 241121 - Fuel No. 1, 5000 Miles

|                                | Emissions in mg/km |          |
|--------------------------------|--------------------|----------|
|                                | COLD-UDDS          | HOT-UDDS |
| Sulfates:                      | 0.86               | 0.22     |
| Ammonia                        | 3.35               | 2.29     |
| Cyanides & Cyanogen            | 0.12               | 0.37     |
| Hydrogen Sulfide               | 0.00               | 0.00     |
| Sulfur Dioxide                 | ----               | ----     |
| <u>Aldehydes &amp; Ketones</u> |                    |          |
| Formaldehyde                   | 3.56               | 1.57     |
| Acetaldehyde                   | 0.10               | 0.00     |
| Acetone                        | 0.00               | 0.00     |
| Isobutyraldehyde               | 0.00               | 0.00     |
| Methyl ethyl ketone            | 0.00               | 0.00     |
| Crotonaldehyde                 | ----               | ----     |
| Hexanaldehyde                  | 0.00               | 0.00     |
| Benzaldehyde                   | ----               | ----     |
| <u>Organic Sulfides</u>        |                    |          |
| Carbonyl sulfide               | 0.08               | 0.02     |
| Methyl sulfide                 | 0.06               | 0.04     |
| Ethyl sulfide                  | 0.12               | 0.00     |
| Methyl disulfide               | 0.04               | 0.00     |
| <u>Organic Amines</u>          |                    |          |
| Monomethylamine                | 0.00               | 0.00     |
| Monoethylamine & dimethylamine | 0.01               | 0.02     |
| Trimethylamine                 | 0.00               | 0.00     |
| Diethylamine                   | 0.00               | 0.00     |
| Triethylamine                  | 0.00               | 0.00     |

|                                | Emissions in ppm |      |          |      |
|--------------------------------|------------------|------|----------|------|
|                                | COLD-UDDS        |      | HOT-UDDS |      |
|                                | 1                | 2    | 3        | 4    |
| <u>Individual Hydrocarbons</u> |                  |      |          |      |
| Methane                        | 6.06             | 5.28 | 4.20     | 5.04 |
| Ethylene                       | 1.28             | 0.01 | 0.44     | 0.05 |
| Ethane                         | 0.79             | 0.50 | 0.69     | 0.54 |
| Acetylene                      | 0.41             | 0.00 | 0.00     | 0.00 |
| Propane                        | 0.15             | 0.00 | 0.06     | 0.05 |
| Propylene                      | 0.54             | 0.00 | 0.00     | 0.00 |
| Benzene                        | 2.62             | 0.18 | 0.83     | 0.15 |
| Toluene                        | 3.35             | 0.02 | 0.25     | 0.07 |
| <u>Other</u>                   |                  |      |          |      |
| Nitrous Oxide                  | 1.41             | 0.27 | 1.35     | 0.38 |
| Nickel Carbonyl                | 0.00             | 0.00 | 0.00     | 0.00 |

TABLE C-81. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test 241211 - Fuel No. 2, 5000 Miles

|                                | Emissions in mg/km |          |          |      |
|--------------------------------|--------------------|----------|----------|------|
|                                | COLD-UDDS          | HOT-UDDS |          |      |
| Sulfates                       | 1.08               | 2.99     |          |      |
| Ammonia                        | 4.67               | 1.85     |          |      |
| Cyanides & Cyanogen            | 0.40               | 0.53     |          |      |
| Hydrogen Sulfide               | 0.00               | 0.00     |          |      |
| Sulfur Dioxide                 | ----               | ----     |          |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |          |      |
| Formaldehyde                   | 2.82               | 2.96     |          |      |
| Acetaldehyde                   | 0.00               | 0.00     |          |      |
| Acetone                        | 0.00               | 0.00     |          |      |
| Isobutyraldehyde               | 0.64               | 0.34     |          |      |
| Methyl ethyl ketone            | 0.00               | 0.00     |          |      |
| Crotonaldehyde                 | ----               | ----     |          |      |
| Hexanaldehyde                  | 0.00               | 0.00     |          |      |
| Benzaldehyde                   | ----               | ----     |          |      |
| <u>Organic Sulfides</u>        |                    |          |          |      |
| Carbonyl sulfide               | 0.43               | 0.94     |          |      |
| Methyl sulfide                 | 0.10               | 0.35     |          |      |
| Ethyl sulfide                  | 0.00               | 0.00     |          |      |
| Methyl disulfide               | 0.01               | 0.04     |          |      |
| <u>Organic Amines</u>          |                    |          |          |      |
| Monomethylamine                | 0.00               | 0.01     |          |      |
| Monoethylamine & dimethylamine | 0.02               | 0.02     |          |      |
| Trimethylamine                 | 0.01               | 0.01     |          |      |
| Diethylamine                   | 0.00               | 0.00     |          |      |
| Triethylamine                  | 0.00               | 0.00     |          |      |
| <u>Emissions in ppm</u>        |                    |          |          |      |
|                                | COLD-UDDS          |          | HOT-UDDS |      |
|                                | 1                  | 2        | 3        | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |          |      |
| Methane                        | 7.19               | 4.92     | 4.41     | 4.84 |
| Ethylene                       | 1.85               | 0.11     | 0.51     | 0.17 |
| Ethane                         | 1.08               | 0.74     | 0.92     | 0.76 |
| Acetylene                      | 0.86               | 0.00     | 0.00     | 0.00 |
| Propane                        | 0.13               | 0.02     | 0.05     | 0.01 |
| Propylene                      | 0.77               | 0.00     | 0.06     | 0.00 |
| Benzene                        | 2.87               | 0.18     | 0.81     | 0.14 |
| Toluene                        | 3.12               | 0.00     | 0.00     | 0.00 |
| <u>Other</u>                   |                    |          |          |      |
| Nitrous Oxide                  | 1.74               | 0.42     | 2.07     | 0.52 |
| Nickel Carbonyl                | 0.00               | 0.00     | 0.00     | 0.00 |

TABLE C-82. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test 241221 - Fuel No. 2, 5000 Miles

|                                | Emissions in mg/km |          |
|--------------------------------|--------------------|----------|
|                                | COLD-UDDS          | HOT-UDDS |
| Sulfates                       | 2.11               | 5.41     |
| Ammonia                        | 2.42               | 1.73     |
| Cyanides & Cyanogen            | 0.00               | 0.00     |
| Hydrogen Sulfide               | 0.00               | 0.00     |
| Sulfur Dioxide                 | ----               | ----     |
| <u>Aldehydes &amp; Ketones</u> |                    |          |
| Formaldehyde                   | 2.77               | 1.45     |
| Acetaldehyde                   | 0.05               | 0.14     |
| Acetone                        | 0.00               | 0.20     |
| Isobutyraldehyde               | 0.00               | 0.00     |
| Methyl ethyl ketone            | 0.00               | 0.00     |
| Crotonaldehyde                 | ----               | ----     |
| Hexanaldehyde                  | 0.00               | 0.00     |
| Benzaldehyde                   | ----               | ----     |
| <u>Organic Sulfides</u>        |                    |          |
| Carbonyl sulfide               | 0.08               | 0.05     |
| Methyl sulfide                 | 0.01               | 0.00     |
| Ethyl sulfide                  | 0.05               | 0.00     |
| Methyl disulfide               | 0.01               | 0.00     |
| <u>Organic Amines</u>          |                    |          |
| Monomethylamine                | 0.00               | 0.00     |
| Monoethylamine & dimethylamine | 0.00               | 0.00     |
| Trimethylamine                 | 0.00               | 0.00     |
| Diethylamine                   | 0.00               | 0.00     |
| Triethylamine                  | 0.00               | 0.00     |

|                                | Emissions in ppm |      |          |      |
|--------------------------------|------------------|------|----------|------|
|                                | COLD-UDDS        |      | HOT-UDDS |      |
|                                | 1                | 2    | 3        | 4    |
| <u>Individual Hydrocarbons</u> |                  |      |          |      |
| Methane                        | 7.51             | 5.12 | 4.58     | 5.13 |
| Ethylene                       | 2.50             | 0.09 | 0.47     | 0.11 |
| Ethane                         | 1.02             | 0.71 | 0.92     | 0.70 |
| Acetylene                      | 0.80             | 0.00 | 0.00     | 0.00 |
| Propane                        | 0.16             | 0.02 | 0.04     | 0.08 |
| Propylene                      | 1.11             | 0.00 | 0.03     | 0.00 |
| Benzene                        | 3.92             | 0.15 | 0.73     | 0.21 |
| Toluene                        | 6.36             | 0.00 | 0.22     | 0.01 |
| <u>Other</u>                   |                  |      |          |      |
| Nitrous Oxide                  | 1.64             | 0.26 | 0.88     | 0.32 |
| Nickel Carbonyl                | 0.00             | 0.00 | 0.00     | 0.00 |

TABLE C-83. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test 241311 - Fuel No. 3, 5000 Miles

|                                | Emissions in mg/km |          |      |      |
|--------------------------------|--------------------|----------|------|------|
|                                | COLD-UDDS          | HOT-UDDS |      |      |
| Sulfates                       | 0.77               | 0.35     |      |      |
| Ammonia                        | 2.95               | 3.82     |      |      |
| Cyanides & Cyanogen            | 0.42               | 0.00     |      |      |
| Hydrogen Sulfide               | 0.00               | 0.00     |      |      |
| Sulfur Dioxide                 | ----               | ----     |      |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |      |      |
| Formaldehyde                   | 2.01               | 1.98     |      |      |
| Acetaldehyde                   | 0.00               | 0.00     |      |      |
| Acetone                        | 0.00               | 0.00     |      |      |
| Isobutyraldehyde               | 1.34               | 0.00     |      |      |
| Methyl ethyl ketone            | 0.00               | 0.00     |      |      |
| Crotonaldehyde                 | ----               | ----     |      |      |
| Hexanaldehyde                  | 0.00               | 0.00     |      |      |
| Benzaldehyde                   | ----               | ----     |      |      |
| <u>Organic Sulfides</u>        |                    |          |      |      |
| Carbonyl sulfide               | 0.09               | 0.10     |      |      |
| Methyl sulfide                 | 0.00               | 0.03     |      |      |
| Ethyl sulfide                  | 0.00               | 0.00     |      |      |
| Methyl disulfide               | 0.01               | 0.01     |      |      |
| <u>Organic Amines</u>          |                    |          |      |      |
| Monomethylamine                | 0.01               | 0.00     |      |      |
| Monoethylamine & dimethylamine | 0.04               | 0.02     |      |      |
| Trimethylamine                 | 0.00               | 0.00     |      |      |
| Diethylamine                   | 0.00               | 0.00     |      |      |
| Triethylamine                  | 0.00               | 0.00     |      |      |
| <u>Emissions in ppm</u>        |                    |          |      |      |
|                                | COLD-UDDS          | HOT-UDDS |      |      |
|                                | 1                  | 2        | 3    | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |      |      |
| Methane                        | 9.95               | 5.99     | 5.12 | 5.35 |
| Ethylene                       | 2.03               | 0.01     | 0.29 | 0.00 |
| Ethane                         | 1.22               | 0.80     | 1.00 | 0.79 |
| Acetylene                      | 1.96               | 0.00     | 0.00 | 0.00 |
| Propane                        | 0.16               | 0.02     | 0.05 | 0.02 |
| Propylene                      | 1.05               | 0.00     | 0.07 | 0.00 |
| Benzene                        | 0.93               | 0.07     | 0.17 | 0.10 |
| Toluene                        | 0.53               | 0.00     | 0.00 | 0.00 |
| <u>Other</u>                   |                    |          |      |      |
| Nitrous Oxide                  | 1.03               | 0.23     | 0.88 | 0.84 |
| Nickel Carbonyl                |                    |          |      |      |

TABLE C-84. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test 241321 - Fuel No. 3, 5000 Miles

|                                | Emissions in mg/km |          |          |      |
|--------------------------------|--------------------|----------|----------|------|
|                                | COLD-UDDS          | HOT-UDDS |          |      |
| Sulfates                       | 0.27               | 0.70     |          |      |
| Ammonia                        | 2.28               | 2.02     |          |      |
| Cyanides & Cyanogen            | 1.66               | 0.76     |          |      |
| Hydrogen Sulfide               | 0.00               | 0.00     |          |      |
| Sulfur Dioxide                 | ----               | ----     |          |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |          |      |
| Formaldehyde                   | 4.29               | 6.64     |          |      |
| Acetaldehyde                   | 0.06               | 0.13     |          |      |
| Acetone                        | 0.00               | 0.00     |          |      |
| Isobutyraldehyde               | 0.00               | 0.00     |          |      |
| Methyl ethyl ketone            | 0.00               | 0.00     |          |      |
| Crotonaldehyde                 | ----               | ----     |          |      |
| Hexanaldehyde                  | 0.00               | 0.00     |          |      |
| Benzaldehyde                   | ----               | ----     |          |      |
| <u>Organic Sulfides</u>        |                    |          |          |      |
| Carbonyl sulfide               | ----               | ----     |          |      |
| Methyl sulfide                 | ----               | ----     |          |      |
| Ethyl sulfide                  | ----               | ----     |          |      |
| Methyl disulfide               | ----               | ----     |          |      |
| <u>Organic Amines</u>          |                    |          |          |      |
| Monomethylamine                | 0.00               | 0.00     |          |      |
| Monoethylamine & dimethylamine | 0.02               | 0.01     |          |      |
| Trimethylamine                 | 0.00               | 0.00     |          |      |
| Diethylamine                   | 0.00               | 0.00     |          |      |
| Triethylamine                  | 0.00               | 0.00     |          |      |
| <u>Emissions in ppm</u>        |                    |          |          |      |
|                                | COLD-UDDS          |          | HOT-UDDS |      |
|                                | 1                  | 2        | 3        | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |          |      |
| Methane                        | 8.46               | 5.82     | 4.97     | 5.38 |
| Ethylene                       | 1.60               | 0.00     | 0.13     | 0.00 |
| Ethane                         | 1.10               | 0.80     | 1.00     | 0.76 |
| Acetylene                      | 0.91               | 0.00     | 0.00     | 0.00 |
| Propane                        | 0.05               | 0.02     | 0.00     | 0.00 |
| Propylene                      | 0.90               | 0.00     | 0.00     | 0.00 |
| Benzene                        | 0.64               | 0.00     | 0.15     | 0.03 |
| Toluene                        | 0.26               | 0.00     | 0.00     | 0.00 |
| <u>Other</u>                   |                    |          |          |      |
| Nitrous Oxide                  | 1.39               | 0.18     | 1.24     | 0.30 |
| Nickel Carbonyl                | 0.00               | 0.00     | 0.00     | 0.00 |



TABLE C-85. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
TEST 242111 - FUEL NO. 1, 10,000 MILES

|                                | Emissions in mg/km |          |
|--------------------------------|--------------------|----------|
|                                | COLD-UDDS          | HOT-UDDS |
| Sulfates                       | 0.26               | 0.16     |
| Ammonia                        | 2.50               | 1.71     |
| Cyanides & Cyanogen            | 0.81               | 0.42     |
| Hydrogen Sulfide               | 0.00               | 0.00     |
| Sulfur Dioxide                 | ----               | ----     |
| <u>Aldehydes &amp; Ketones</u> |                    |          |
| Formaldehyde                   | 2.43               | 0.98     |
| Acetaldehyde                   | 0.16               | 0.00     |
| Acetone                        | 0.00               | 0.00     |
| Isobutyraldehyde               | 1.94               | 2.49     |
| Methyl ethyl ketone            | 0.00               | 0.00     |
| Crotonaldehyde                 | ----               | ----     |
| Hexanaldehyde                  | 0.00               | 0.00     |
| Benzaldehyde                   | ----               | ----     |
| <u>Organic Sulfides</u>        |                    |          |
| Carbonyl sulfide               | 0.50               | 1.25     |
| Methyl sulfide                 | 0.10               | 0.00     |
| Ethyl sulfide                  | 0.00               | 0.00     |
| Methyl disulfide               | 0.00               | 0.00     |
| <u>Organic Amines</u>          |                    |          |
| Monomethylamine                | 0.00               | 0.01     |
| Monoethylamine & dimethylamine | 0.02               | 0.00     |
| Trimethylamine                 | 0.00               | 0.00     |
| Diethylamine                   | 0.00               | 0.00     |
| Triethylamine                  | 0.00               | 0.00     |

|                                | Emissions in ppm |      |          |      |
|--------------------------------|------------------|------|----------|------|
|                                | COLD-UDDS        |      | HOT-UDDS |      |
|                                | 1                | 2    | 3        | 4    |
| <u>Individual Hydrocarbons</u> |                  |      |          |      |
| Methane                        | 7.48             | 6.13 | 4.72     | 6.00 |
| Ethylene                       | 1.22             | 0.10 | 0.66     | 0.16 |
| Ethane                         | 0.80             | 0.78 | 0.90     | 0.81 |
| Acetylene                      | 0.71             | 0.00 | 0.00     | 0.00 |
| Propane                        | 0.16             | 0.00 | 0.22     | 0.03 |
| Propylene                      | 0.55             | 0.00 | 0.02     | 0.00 |
| Benzene                        | 2.10             | 0.24 | 1.00     | 0.26 |
| Toluene                        | 2.70             | 0.00 | 0.23     | 0.00 |
| <u>Other</u>                   |                  |      |          |      |
| Nitrous Oxide                  | 1.50             | 0.55 | 2.09     | 1.01 |
| Nickel Carbonyl                | 0.00             | 0.00 | 0.00     | 0.00 |

TABLE C-86. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
TEST 242121 - FUEL NO. 1, 10,000 MILES

|                                | Emissions in mg/km |          |          |      |
|--------------------------------|--------------------|----------|----------|------|
|                                | COLD-UDDS          | HOT-UDDS |          |      |
| Sulfates                       | 0.38               | 0.05     |          |      |
| Ammonia                        | 1.37               | 1.91     |          |      |
| Cyanides & Cyanogen            | 1.44               | 0.63     |          |      |
| Hydrogen Sulfide               | 0.00               | 0.00     |          |      |
| Sulfur Dioxide                 | ----               | ----     |          |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |          |      |
| Formaldehyde                   | 2.25               | 2.65     |          |      |
| Acetaldehyde                   | 0.37               | 0.43     |          |      |
| Acetone                        | 0.00               | 0.00     |          |      |
| Isobutyraldehyde               | 0.00               | 2.37     |          |      |
| Methyl ethyl ketone            | 0.00               | 0.00     |          |      |
| Crotonaldehyde                 | ----               | ----     |          |      |
| Hexanaldehyde                  | 0.00               | 0.00     |          |      |
| Benzaldehyde                   | ----               | ----     |          |      |
| <u>Organic Sulfides</u>        |                    |          |          |      |
| Carbonyl sulfide               | 1.08               | 0.81     |          |      |
| Methyl sulfide                 | 0.03               | 0.00     |          |      |
| Ethyl sulfide                  | 0.03               | 0.00     |          |      |
| Methyl disulfide               | 0.02               | 0.00     |          |      |
| <u>Organic Amines</u>          |                    |          |          |      |
| Monomethylamine                | 0.00               | 0.00     |          |      |
| Monoethylamine & dimethylamine | 0.01               | 0.01     |          |      |
| Trimethylamine                 | 0.00               | 0.00     |          |      |
| Diethylamine                   | 0.00               | 0.00     |          |      |
| Triethylamine                  | 0.00               | 0.00     |          |      |
| <u>Emissions in ppm</u>        |                    |          |          |      |
|                                | COLD-UDDS          |          | HOT-UDDS |      |
|                                | 1                  | 2        | 3        | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |          |      |
| Methane                        | 7.89               | 5.82     | 4.08     | 5.45 |
| Ethylene                       | 1.85               | 0.16     | 0.46     | 0.08 |
| Ethane                         | 0.90               | 0.76     | 0.76     | 0.72 |
| Acetylene                      | 0.93               | 0.00     | 0.00     | 0.00 |
| Propane                        | 0.00               | 0.00     | 0.00     | 0.00 |
| Propylene                      | 0.76               | 0.00     | 0.02     | 0.00 |
| Benzene                        | 2.59               | 0.27     | 0.76     | 0.22 |
| Toluene                        | 3.58               | 0.00     | 0.22     | 0.00 |
| <u>Other</u>                   |                    |          |          |      |
| Nitrous Oxide                  | 1.09               | 0.44     | 1.24     | 0.38 |
| Nickel Carbonyl                | 0.00               | 0.00     | 0.00     | 0.00 |

TABLE C-87. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
TEST 242211 - FUEL NO.2, 10,000 MILES

|                                | Emissions in mg/km |          |
|--------------------------------|--------------------|----------|
|                                | COLD-UDDS          | HOT-UDDS |
| Sulfates                       | 0.38               | 0.58     |
| Ammonia                        | 1.83               | 1.07     |
| Cyanides & Cyanogen            | 0.29               | 0.39     |
| Hydrogen Sulfide               | 0.00               | 0.00     |
| Sulfur Dioxide                 | ----               | ----     |
| <u>Aldehydes &amp; Ketones</u> |                    |          |
| Formaldehyde                   | 3.70               | 2.49     |
| Acetaldehyde                   | 0.53               | 0.36     |
| Acetone                        | 0.00               | 0.00     |
| Isobutyraldehyde               | 1.75               | 1.31     |
| Methyl ethyl ketone            | 0.00               | 0.00     |
| Crotonaldehyde                 | ----               | ----     |
| Hexanaldehyde                  | 0.00               | 0.00     |
| Benzaldehyde                   | ----               | ----     |
| <u>Organic Sulfides</u>        |                    |          |
| Carbonyl sulfide               | 1.15               | 0.00     |
| Methyl sulfide                 | 0.08               | 0.03     |
| Ethyl sulfide                  | 0.01               | 0.02     |
| Methyl disulfide               | 0.01               | 0.00     |
| <u>Organic Amines</u>          |                    |          |
| Monomethylamine                | 0.01               | 0.01     |
| Monoethylamine & dimethylamine | 0.01               | 0.02     |
| Trimethylamine                 | 0.00               | 0.00     |
| Diethylamine                   | 0.00               | 0.00     |
| Triethylamine                  | 0.00               | 0.00     |

|                                | Emissions in ppm |      |          |      |
|--------------------------------|------------------|------|----------|------|
|                                | COLD-UDDS        |      | HOT-UDDS |      |
|                                | 1                | 2    | 3        | 4    |
| <u>Individual Hydrocarbons</u> |                  |      |          |      |
| Methane                        | 8.62             | 5.79 | 4.62     | 5.55 |
| Ethylene                       | 2.19             | 0.23 | 0.65     | 0.20 |
| Ethane                         | 0.94             | 0.83 | 0.93     | 0.82 |
| Acetylene                      | 0.90             | 0.00 | 0.00     | 0.00 |
| Propane                        | 0.02             | 0.02 | 0.05     | 0.03 |
| Propylene                      | 0.87             | 0.00 | 0.05     | 0.00 |
| Benzene                        | 3.44             | 0.16 | 1.01     | 0.17 |
| Toluene                        | 4.22             | 0.01 | 0.10     | 0.00 |
| <u>Other</u>                   |                  |      |          |      |
| Nitrous Oxide                  | 1.54             | 0.55 | 1.85     | 0.51 |
| Nickel Carbonyl                | 0.00             | 0.00 | 0.00     | 0.00 |

TABLE C-88. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
TEST 242221 - FUEL NO. 2, 10,000 MILES

|                                | Emissions in mg/km |          |          |      |
|--------------------------------|--------------------|----------|----------|------|
|                                | COLD-UDDS          | HOT-UDDS |          |      |
| Sulfates                       | 1.00               | 7.51     |          |      |
| Ammonia                        | 0.81               | 1.69     |          |      |
| Cyanides & Cyanogen            | 0.11               | 0.11     |          |      |
| Hydrogen Sulfide               | 0.00               | 0.00     |          |      |
| Sulfur Dioxide                 | ----               | ----     |          |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |          |      |
| Formaldehyde                   | 3.43               | 4.08     |          |      |
| Acetaldehyde                   | 0.66               | 0.62     |          |      |
| Acetone                        | 0.00               | 0.00     |          |      |
| Isobutyraldehyde               | 3.06               | 2.66     |          |      |
| Methyl ethyl ketone            | 0.00               | 0.00     |          |      |
| Crotonaldehyde                 | ----               | ----     |          |      |
| Hexanaldehyde                  | 0.00               | 0.00     |          |      |
| Benzaldehyde                   | ----               | ----     |          |      |
| <u>Organic Sulfides</u>        |                    |          |          |      |
| Carbonyl sulfide               | 0.65               | 0.03     |          |      |
| Methyl sulfide                 | 0.00               | 0.00     |          |      |
| Ethyl sulfide                  | 0.02               | 0.00     |          |      |
| Methyl disulfide               | 0.00               | 0.00     |          |      |
| <u>Organic Amines</u>          |                    |          |          |      |
| Monomethylamine                | 0.00               | 0.00     |          |      |
| Monoethylamine & dimethylamine | 0.03               | 0.02     |          |      |
| Trimethylamine                 | 0.00               | 0.00     |          |      |
| Diethylamine                   | 0.00               | 0.00     |          |      |
| Triethylamine                  | 0.00               | 0.00     |          |      |
| <br>Emissions in ppm           |                    |          |          |      |
|                                | COLD-UDDS          |          | HOT-UDDS |      |
|                                | 1                  | 2        | 3        | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |          |      |
| Methane                        | 7.76               | 4.77     | 4.06     | 5.24 |
| Ethylene                       | 1.82               | 0.19     | 0.43     | 0.18 |
| Ethane                         | 0.92               | 0.73     | 0.83     | 0.79 |
| Acetylene                      | 1.50               | 0.00     | 0.00     | 0.00 |
| Propane                        | 0.03               | 0.03     | 0.03     | 0.03 |
| Propylene                      | 0.74               | 0.00     | 0.00     | 0.00 |
| Benzene                        | 4.85               | 0.18     | 0.69     | 0.22 |
| Toluene                        | 9.11               | 0.04     | 0.19     | 0.00 |
| <u>Other</u>                   |                    |          |          |      |
| Nitrous Oxide                  | 1.12               | 0.56     | 1.95     | 0.49 |
| Nickel Carbonyl                | 0.00               | 0.00     | 0.00     | 0.00 |

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TABLE C-89. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test 242321 - Fuel No. 3, 10,000 Miles

|                                | Emissions in mg/km |          |
|--------------------------------|--------------------|----------|
|                                | COLD-UDDS          | HOT-UDDS |
| Sulfates                       | 0.25               | 0.94     |
| Ammonia                        | 5.54               | 2.05     |
| Cyanides & Cyanogen            | 0.30               | 0.08     |
| Hydrogen Sulfide               | 0.00               | 0.00     |
| Sulfur Dioxide                 | ----               | ----     |
| <u>Aldehydes &amp; Ketones</u> |                    |          |
| Formaldehyde                   | 5.38               | 4.83     |
| Acetaldehyde                   | 0.00               | 0.00     |
| Acetone                        | 0.00               | 0.00     |
| Isobutyraldehyde               | 0.00               | 0.00     |
| Methyl ethyl ketone            | 0.00               | 0.00     |
| Crotonaldehyde                 | ----               | ----     |
| Hexanaldehyde                  | 0.00               | 0.00     |
| Benzaldehyde                   | ----               | ----     |
| <u>Organic Sulfides</u>        |                    |          |
| Carbonyl sulfide               | 0.00               | 0.00     |
| Methyl sulfide                 | 0.00               | 0.03     |
| Ethyl sulfide                  | 0.00               | 0.00     |
| Methyl disulfide               | 0.00               | 0.00     |
| <u>Organic Amines</u>          |                    |          |
| Monomethylamine                | 0.00               | ----     |
| Monoethylamine & dimethylamine | 0.02               | ----     |
| Trimethylamine                 | 0.00               | ----     |
| Diethylamine                   | 0.00               | ----     |
| Triethylamine                  | 0.00               | ----     |

|                                | Emissions in ppm |      |          |      |
|--------------------------------|------------------|------|----------|------|
|                                | COLD-UDDS        |      | HOT-UDDS |      |
|                                | 1                | 2    | 3        | 4    |
| <u>Individual Hydrocarbons</u> |                  |      |          |      |
| Methane                        | 8.94             | 6.35 | 5.19     | 5.35 |
| Ethylene                       | 2.28             | 0.01 | 0.44     | 0.02 |
| Ethane                         | 1.13             | 0.95 | 1.08     | 0.87 |
| Acetylene                      | 1.21             | 0.00 | 0.00     | 0.00 |
| Propane                        | 0.14             | 0.03 | 0.05     | 0.02 |
| Propylene                      | 1.16             | 0.00 | 0.06     | 0.00 |
| Benzene                        | 1.02             | 0.02 | 0.15     | 0.05 |
| Toluene                        | 0.78             | 0.00 | 0.02     | 0.00 |
| <u>Other</u>                   |                  |      |          |      |
| Nitrous Oxide                  | 1.84             | 0.51 | 1.31     | 0.37 |
| Nickel Carbonyl                | ----             | ---- | ----     | ---- |

TABLE C-90. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS

Test 242311 - Fuel No. 3, 10,000 Miles

|                                | Emissions in mg/km |          |      |      |
|--------------------------------|--------------------|----------|------|------|
|                                | COLD-UDDS          | HOT-UDDS |      |      |
| Sulfates                       | 0.23               | 0.31     |      |      |
| Ammonia                        | 0.88               | 1.81     |      |      |
| Cyanides & Cyanogen            | 1.16               | 0.33     |      |      |
| Hydrogen Sulfide               | 0.00               | 0.00     |      |      |
| Sulfur Dioxide                 | ----               | ----     |      |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |      |      |
| Formaldehyde                   | 3.92               | 3.93     |      |      |
| Acetaldehyde                   | 0.64               | 0.22     |      |      |
| Acetone                        | 0.00               | 0.00     |      |      |
| Isobutyraldehyde               | 0.00               | 0.00     |      |      |
| Methyl ethyl ketone            | 0.00               | 0.00     |      |      |
| Crotonaldehyde                 | ----               | ----     |      |      |
| Hexanaldehyde                  | 0.00               | 0.00     |      |      |
| Benzaldehyde                   | ----               | ----     |      |      |
| <u>Organic Sulfides</u>        |                    |          |      |      |
| Carbonyl sulfide               | 0.88               | 1.48     |      |      |
| Methyl sulfide                 | 0.01               | 0.07     |      |      |
| Ethyl sulfide                  | 0.00               | 0.00     |      |      |
| Methyl disulfide               | 0.00               | 0.00     |      |      |
| <u>Organic Amines</u>          |                    |          |      |      |
| Monomethylamine                | 0.00               | 0.01     |      |      |
| Monoethylamine & dimethylamine | 0.00               | 0.04     |      |      |
| Trimethylamine                 | 0.00               | 0.00     |      |      |
| Diethylamine                   | 0.00               | 0.00     |      |      |
| Triethylamine                  | 0.00               | 0.00     |      |      |
|                                | Emissions in ppm   |          |      |      |
|                                | COLD-UDDS          | HOT-UDDS |      |      |
|                                | 1                  | 2        | 3    | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |      |      |
| Methane                        | 10.61              | 5.53     | 5.25 | 5.55 |
| Ethylene                       | 2.51               | 0.05     | 0.56 | 0.03 |
| Ethane                         | 1.16               | 0.92     | 1.25 | 0.89 |
| Acetylene                      | 1.91               | 0.00     | 0.00 | 0.00 |
| Propane                        | 0.11               | 0.05     | 0.10 | 0.04 |
| Propylene                      | 1.27               | 0.00     | 0.12 | 0.00 |
| Benzene                        | 1.45               | 0.10     | 0.20 | 0.08 |
| Toluene                        | 1.38               | 0.01     | 0.05 | 0.10 |
| <u>Other</u>                   |                    |          |      |      |
| Nitrous Oxide                  | 1.67               | 0.48     | 2.07 | 0.46 |
| Nickel Carbonyl                | 0.00               | 0.00     | 0.00 | 0.00 |

TABLE C-91. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS

Test 243111 - Fuel No. 1, 15,000 Miles

|                                | Emissions in mg/km |          |          |      |
|--------------------------------|--------------------|----------|----------|------|
|                                | COLD-UDDS          | HOT-UDDS |          |      |
| Sulfates                       | 0.09               | 0.03     |          |      |
| Ammonia                        | 2.46               | 1.82     |          |      |
| Cyanides & Cyanogen            | 1.49               | 1.62     |          |      |
| Hydrogen Sulfide               | 0.00               | 0.00     |          |      |
| Sulfur Dioxide                 | 5.61               | 8.41     |          |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |          |      |
| Formaldehyde                   | 1.46               | 1.91     |          |      |
| Acetaldehyde                   | 0.16               | 0.16     |          |      |
| Acetone                        | 0.00               | 0.00     |          |      |
| Isobutyraldehyde               | 0.23               | 3.38     |          |      |
| Methyl ethyl ketone            | 0.00               | 0.00     |          |      |
| Crotonaldehyde                 | ----               | ----     |          |      |
| Hexanaldehyde                  | 0.00               | 0.00     |          |      |
| Benzaldehyde                   | ----               | ----     |          |      |
| <u>Organic Sulfides</u>        |                    |          |          |      |
| Carbonyl sulfide               | 0.11               | 0.00     |          |      |
| Methyl sulfide                 | 0.00               | 0.02     |          |      |
| Ethyl sulfide                  | 0.00               | 0.03     |          |      |
| Methyl disulfide               | 0.00               | 0.00     |          |      |
| <u>Organic Amines</u>          |                    |          |          |      |
| Monomethylamine                | 0.00               | 0.00     |          |      |
| Monoethylamine & dimethylamine | 0.00               | 0.00     |          |      |
| Trimethylamine                 | 0.00               | 0.00     |          |      |
| Diethylamine                   | 0.00               | 0.00     |          |      |
| Triethylamine                  | 0.00               | 0.00     |          |      |
| <u>Emissions in ppm</u>        |                    |          |          |      |
|                                | COLD-UDDS          |          | HOT-UDDS |      |
|                                | 1                  | 2        | 3        | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |          |      |
| Methane                        | 6.73               | 6.45     | 5.38     | 5.97 |
| Ethylene                       | 2.15               | 0.43     | 0.00     | 0.38 |
| Ethane                         | 0.95               | 0.93     | 1.28     | 0.87 |
| Acetylene                      | 0.77               | 0.00     | 1.22     | 0.00 |
| Propane                        | 0.00               | 0.12     | 0.12     | 0.00 |
| Propylene                      | 0.89               | 0.00     | 0.18     | 0.00 |
| Benzene                        | 3.13               | 0.65     | 2.01     | 0.54 |
| Toluene                        | 3.51               | 0.00     | 1.18     | 0.00 |
| <u>Other</u>                   |                    |          |          |      |
| Nitrous Oxide                  | 1.67               | 0.54     | 2.18     | 0.63 |
| Nickel Carbonyl                | 0.00               | 0.00     | 0.00     | 0.00 |

TABLE C-92. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test 243121 - Fuel No. 1, 15,000 Miles

|                                | Emissions in mg/km |          |          |      |
|--------------------------------|--------------------|----------|----------|------|
|                                | COLD-UDDS          | HOT-UDDS |          |      |
| Sulfates                       | 0.03               | 0.00     |          |      |
| Ammonia                        | 1.46               | 1.55     |          |      |
| Cyanides & Cyanogen            | 1.84               | 1.47     |          |      |
| Hydrogen Sulfide               | 0.00               | 0.00     |          |      |
| Sulfur Dioxide                 | 10.14              | 6.00     |          |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |          |      |
| Formaldehyde                   | ----               | ----     |          |      |
| Acetaldehyde                   | ----               | ----     |          |      |
| Acetone                        | ----               | ----     |          |      |
| Isobutyraldehyde               | ----               | ----     |          |      |
| Methyl ethyl ketone            | ----               | ----     |          |      |
| Crotonaldehyde                 | ----               | ----     |          |      |
| Hexanaldehyde                  | ----               | ----     |          |      |
| Benzaldehyde                   | ----               | ----     |          |      |
| <u>Organic Sulfides</u>        |                    |          |          |      |
| Carbonyl sulfide               | 0.05               | 0.00     |          |      |
| Methyl sulfide                 | 0.00               | 0.04     |          |      |
| Ethyl sulfide                  | 0.03               | 0.00     |          |      |
| Methyl disulfide               | 0.01               | 0.01     |          |      |
| <u>Organic Amines</u>          |                    |          |          |      |
| Monomethylamine                | 0.00               | 0.00     |          |      |
| Monoethylamine & dimethylamine | 0.04               | 0.08     |          |      |
| Trimethylamine                 | 0.00               | 0.00     |          |      |
| Diethylamine                   | 0.00               | 0.00     |          |      |
| Triethylamine                  | 0.00               | 0.00     |          |      |
| <u>Emissions in ppm</u>        |                    |          |          |      |
|                                | COLD-UDDS          |          | HOT-UDDS |      |
|                                | 1                  | 2        | 3        | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |          |      |
| Methane                        | 6.43               | 5.54     | 4.37     | 5.13 |
| Ethylene                       | 2.46               | 0.46     | 2.21     | 0.41 |
| Ethane                         | 0.88               | 0.80     | 0.84     | 0.74 |
| Acetylene                      | 0.53               | 0.00     | 0.00     | 0.00 |
| Propane                        | 0.16               | 0.14     | 0.05     | 0.05 |
| Propylene                      | 1.00               | 0.16     | 0.75     | 0.00 |
| Benzene                        | 6.93               | 1.22     | 5.85     | 1.05 |
| Toluene                        | 4.14               | 0.05     | 1.98     | 0.00 |
| <u>Other</u>                   |                    |          |          |      |
| Nitrous Oxide                  | 0.77               | 1.05     | 2.60     | 0.78 |
| Nickel Carbonyl                | ----               | ----     | ----     | ---- |



TABLE C-93. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test 243211 - Fuel No. 2, 15,000 Miles

|                                | Emissions in mg/km |          |      |      |
|--------------------------------|--------------------|----------|------|------|
|                                | COLD-UDDS          | HOT-UDDS |      |      |
| Sulfates                       | 0.09               | 0.07     |      |      |
| Ammonia                        | 1.14               | 3.85     |      |      |
| Cyanides & Cyanogen            | 1.59               | 0.51     |      |      |
| Hydrogen Sulfide               | 0.00               | 0.00     |      |      |
| Sulfur Dioxide                 | 20.42              | 32.80    |      |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |      |      |
| Formaldehyde                   | 4.31               | 4.08     |      |      |
| Acetaldehyde                   | 5.94               | 0.78     |      |      |
| Acetone                        | 0.63               | 0.00     |      |      |
| Isobutyraldehyde               | 2.19               | 2.16     |      |      |
| Methyl ethyl ketone            | 0.00               | 0.00     |      |      |
| Crotonaldehyde                 | ----               | ----     |      |      |
| Hexanaldehyde                  | 0.00               | 0.00     |      |      |
| Benzaldehyde                   | ----               | ----     |      |      |
| <u>Organic Sulfides</u>        |                    |          |      |      |
| Carbonyl sulfide               | 0.00               | 0.00     |      |      |
| Methyl sulfide                 | 0.00               | 0.00     |      |      |
| Ethyl sulfide                  | 0.01               | 0.00     |      |      |
| Methyl disulfide               | 0.01               | 0.00     |      |      |
| <u>Organic Amines</u>          |                    |          |      |      |
| Monomethylamine                | 0.00               | 0.00     |      |      |
| Monoethylamine & dimethylamine | 0.07               | 0.03     |      |      |
| Trimethylamine                 | 0.00               | 0.00     |      |      |
| Diethylamine                   | 0.00               | 0.00     |      |      |
| Triethylamine                  | 0.00               | 0.00     |      |      |
| <u>Emissions in ppm</u>        |                    |          |      |      |
|                                | COLD-UDDS          | HOT-UDDS |      |      |
|                                | 1                  | 2        | 3    | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |      |      |
| Methane                        | 7.07               | 5.48     | 5.43 | 5.22 |
| Ethylene                       | 2.21               | 0.37     | 1.14 | 0.32 |
| Ethane                         | 1.02               | 0.93     | 0.98 | 0.79 |
| Acetylene                      | 0.49               | 0.00     | 0.00 | 0.00 |
| Propane                        | 0.00               | 0.00     | 0.00 | 0.00 |
| Propylene                      | 0.97               | 0.00     | 0.09 | 0.00 |
| Benzene                        | 3.73               | 0.43     | 1.98 | 0.34 |
| Toluene                        | 4.01               | 0.00     | 0.85 | 0.00 |
| <u>Other</u>                   |                    |          |      |      |
| Nitrous Oxide                  | 1.56               | 0.57     | 1.95 | 0.71 |
| Nickel Carbonyl                | 0.00               | 0.00     | 0.00 | 0.00 |

TABLE C-94. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS

Test 243221 - Fuel No. 2, 15,000 Miles

|                                | Emissions in mg/km |          |          |      |
|--------------------------------|--------------------|----------|----------|------|
|                                | COLD-UDDS          | HOT-UDDS |          |      |
| Sulfates                       | 0.14               | 0.37     |          |      |
| Ammonia                        | 4.51               | 1.65     |          |      |
| Cyanides & Cyanogen            | 1.75               | 0.33     |          |      |
| Hydrogen Sulfide               | 0.00               | 0.00     |          |      |
| Sulfur Dioxide                 | 29.03              | 32.24    |          |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |          |      |
| Formaldehyde                   | 2.65               | 2.65     |          |      |
| Acetaldehyde                   | 0.00               | 0.00     |          |      |
| Acetone                        | 0.00               | 0.00     |          |      |
| Isobutyraldehyde               | 3.80               | 5.89     |          |      |
| Methyl ethyl ketone            | 0.00               | 0.00     |          |      |
| Crotonaldehyde                 | ----               | ----     |          |      |
| Hexanaldehyde                  | 0.00               | 0.00     |          |      |
| Benzaldehyde                   | ----               | ----     |          |      |
| <u>Organic Sulfides</u>        |                    |          |          |      |
| Carbonyl sulfide               | 0.00               | 0.00     |          |      |
| Methyl sulfide                 | 0.00               | 0.00     |          |      |
| Ethyl sulfide                  | 0.00               | 0.00     |          |      |
| Methyl disulfide               | 0.00               | 0.00     |          |      |
| <u>Organic Amines</u>          |                    |          |          |      |
| Monomethylamine                | 0.03               | 0.03     |          |      |
| Monoethylamine & dimethylamine | 0.03               | 0.00     |          |      |
| Trimethylamine                 | 0.00               | 0.00     |          |      |
| Diethylamine                   | 0.00               | 0.00     |          |      |
| Triethylamine                  | 0.00               | 0.00     |          |      |
| <u>Emissions in ppm</u>        |                    |          |          |      |
|                                | COLD-UDDS          |          | HOT-UDDS |      |
|                                | 1                  | 2        | 3        | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |          |      |
| Methane                        | 6.98               | 5.08     | 4.92     | 4.72 |
| Ethylene                       | 2.05               | 0.32     | 1.31     | 0.29 |
| Ethane                         | 0.98               | 0.87     | 1.03     | 0.83 |
| Acetylene                      | 0.46               | 0.00     | 0.00     | 0.00 |
| Propane                        | 0.19               | 0.08     | 0.18     | 0.04 |
| Propylene                      | 0.90               | 0.00     | 0.19     | 0.00 |
| Benzene                        | 3.65               | 0.32     | 1.93     | 0.21 |
| Toluene                        | 4.71               | 0.00     | 0.94     | 0.00 |
| <u>Other</u>                   |                    |          |          |      |
| Nitrous Oxide                  | 1.61               | 0.73     | 2.13     | 0.65 |
| Nickel Carbonyl                | ----               | ----     | ----     | ---- |

TABLE C-95. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test 243311 - Fuel No. 3, 15,000 Miles

|                                | Emissions in mg/km |          |      |      |
|--------------------------------|--------------------|----------|------|------|
|                                | COLD-UDDS          | HOT-UDDS |      |      |
| Sulfates                       | 0.68               | 1.38     |      |      |
| Ammonia                        | 0.58               | 2.57     |      |      |
| Cyanides & Cyanogen            | 0.38               | 0.53     |      |      |
| Hydrogen Sulfide               | 0.00               | 0.00     |      |      |
| Sulfur Dioxide                 | 18.85              | 22.98    |      |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |      |      |
| Formaldehyde                   | 5.25               | 3.53     |      |      |
| Acetaldehyde                   | 0.30               | 0.81     |      |      |
| Acetone                        | 0.00               | 0.00     |      |      |
| Isobutyraldehyde               | 1.20               | 0.82     |      |      |
| Methyl ethyl ketone            | 0.00               | 0.00     |      |      |
| Crotonaldehyde                 | ----               | ----     |      |      |
| Hexanaldehyde                  | 0.62               | 0.59     |      |      |
| Benzaldehyde                   | ----               | ----     |      |      |
| <u>Organic Sulfides</u>        |                    |          |      |      |
| Carbonyl sulfide               | 0.00               | 0.00     |      |      |
| Methyl sulfide                 | 0.00               | 0.05     |      |      |
| Ethyl sulfide                  | 0.00               | 0.06     |      |      |
| Methyl disulfide               | 0.00               | 0.05     |      |      |
| <u>Organic Amines</u>          |                    |          |      |      |
| Monomethylamine                | 0.03               | 0.00     |      |      |
| Monoethylamine & dimethylamine | 0.01               | 0.03     |      |      |
| Trimethylamine                 | 0.00               | 0.00     |      |      |
| Diethylamine                   | 0.00               | 0.00     |      |      |
| Triethylamine                  | 0.00               | 0.00     |      |      |
| Emissions in ppm               |                    |          |      |      |
|                                | COLD-UDDS          | HOT-UDDS |      |      |
|                                | 1                  | 2        | 3    | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |      |      |
| Methane                        | 9.61               | 5.47     | 6.23 | 5.92 |
| Ethylene                       | 2.35               | 0.03     | 0.59 | 0.02 |
| Ethane                         | 1.23               | 0.97     | 1.23 | 0.97 |
| Acetylene                      | 1.03               | 0.00     | 0.00 | 0.00 |
| Propane                        | 0.23               | 0.09     | 0.10 | 0.05 |
| Propylene                      | 1.11               | 0.00     | 0.07 | 0.00 |
| Benzene                        | 1.16               | 0.00     | 0.15 | 0.03 |
| Toluene                        | 0.37               | 0.00     | 0.02 | 0.00 |
| <u>Other</u>                   |                    |          |      |      |
| Nitrous Oxide                  | ----               | 0.33     | 1.27 | 0.27 |
| Nickel Carbonyl                | 0.00               | 0.00     | 0.00 | 0.00 |

TABLE C-96. FTP INDIVIDUAL SAMPLE UNREGULATED EMISSIONS RESULTS  
Test 243321 - Fuel No. 3, 15,000 Miles

|                                | Emissions in mg/km |          |      |      |
|--------------------------------|--------------------|----------|------|------|
|                                | COLD-UDDS          | HOT-UDDS |      |      |
| Sulfates                       | 1.07               | 1.98     |      |      |
| Ammonia                        | 5.46               | 1.99     |      |      |
| Cyanides & Cyanogen            | 0.10               | 0.02     |      |      |
| Hydrogen Sulfide               | ----               | ----     |      |      |
| Sulfur Dioxide                 | 19.29              | 20.62    |      |      |
| <u>Aldehydes &amp; Ketones</u> |                    |          |      |      |
| Formaldehyde                   | 10.48              | 9.16     |      |      |
| Acetaldehyde                   | 1.59               | 1.23     |      |      |
| Acetone                        | 0.00               | 0.00     |      |      |
| Isobutyraldehyde               | 1.68               | 0.53     |      |      |
| Methyl ethyl ketone            | 0.00               | 0.00     |      |      |
| Crotonaldehyde                 | ----               | ----     |      |      |
| Hexanaldehyde                  | 1.47               | 0.82     |      |      |
| Benzaldehyde                   | ----               | ----     |      |      |
| <u>Organic Sulfides</u>        |                    |          |      |      |
| Carbonyl sulfide               | 0.08               | 0.00     |      |      |
| Methyl sulfide                 | 0.00               | 0.01     |      |      |
| Ethyl sulfide                  | 0.00               | 0.00     |      |      |
| Methyl disulfide               | 0.00               | 0.00     |      |      |
| <u>Organic Amines</u>          |                    |          |      |      |
| Monomethylamine                | 0.00               | 0.03     |      |      |
| Monoethylamine & dimethylamine | 0.04               | 0.03     |      |      |
| Trimethylamine                 | 0.00               | 0.00     |      |      |
| Diethylamine                   | 0.00               | 0.00     |      |      |
| Triethylamine                  | 0.00               | 0.00     |      |      |
|                                | Emissions in ppm   |          |      |      |
|                                | COLD-UDDS          | HOT-UDDS |      |      |
|                                | 1                  | 2        | 3    | 4    |
| <u>Individual Hydrocarbons</u> |                    |          |      |      |
| Methane                        | 4.14               | 0.69     | 2.29 | 1.11 |
| Ethylene                       | 2.31               | 0.02     | 1.05 | 0.00 |
| Ethane                         | 0.22               | 0.02     | 0.36 | 0.02 |
| Acetylene                      | 1.17               | 0.00     | 0.00 | 0.00 |
| Propane                        | 0.02               | 0.01     | 0.02 | 0.01 |
| Propylene                      | 1.31               | 0.00     | 0.15 | 0.00 |
| Benzene                        | 0.87               | 0.00     | 0.21 | 0.00 |
| Toluene                        | 0.73               | 0.00     | 0.02 | 0.00 |
| <u>Other</u>                   |                    |          |      |      |
| Nitrous Oxide                  | 1.90               | 0.54     | 2.38 | 0.55 |
| Nickel Carbonyl                | ----               | ----     | ---- | ---- |